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VOLUME XIV NOVEMBER 2, 1925 NUMBER 18

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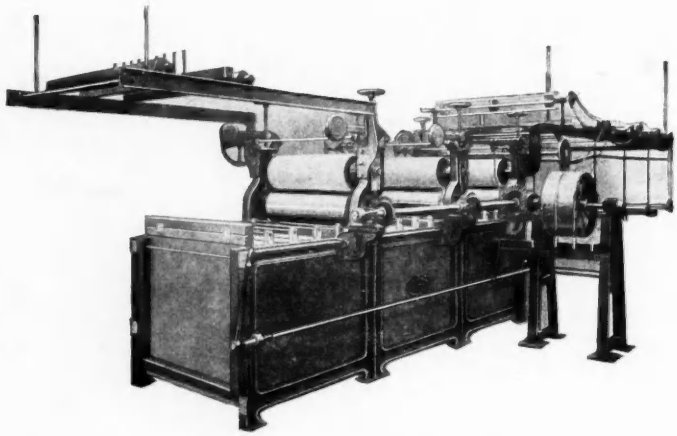

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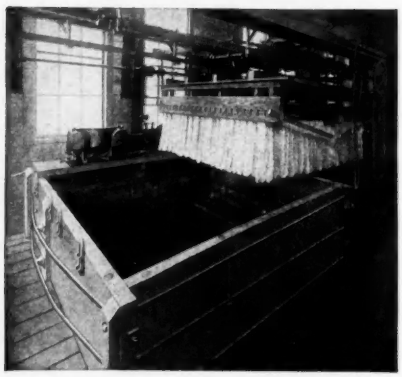

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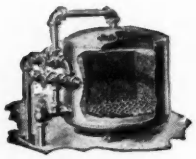

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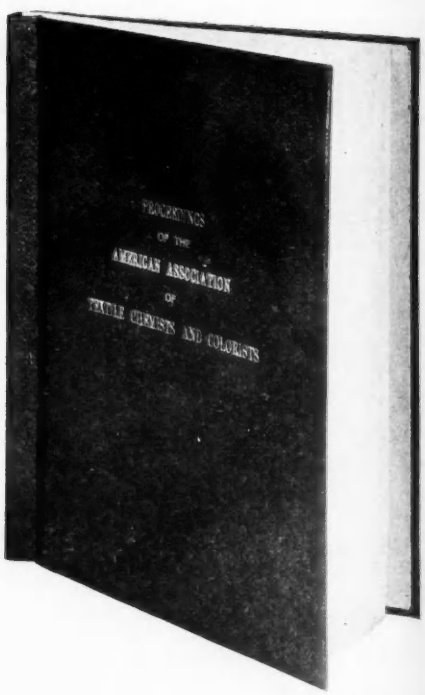

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Contents of This Issue

November 2, 1925

Artificial Silk and the Textile Industry.... 713
Gustavus J. Esselen

Roughness of Dyed Silk Hosiery..... 717
C. E. Bick

Slashing—A Discussion 717

What the Chemical Industry of the Country Means to the Chemical Warfare Service 719
Maj.-Gen. Amos A. Fries

Safe Methods of Boiling Starch..... 723

Colors for Spring..... 724

Proceedings of the American Association of Textile Chemists and Colorists:
Annual Meeting of the Southern Section.. 725
The Bleaching, Dyeing and Finishing of Cotton Fabrics Containing Rayon—*A Paper* by R. W. Arrington. 726
Thirty-third Council Meeting..... 728
October Meeting of the Northern New England Section 729
Applicants for Membership..... 729
Resignations 730
Changes of Address..... 730
Annual Meeting Announcement..... ... 730

Reduced Demand for Foreign Silks..... 731

The Reduction Products of Azo Dyes—Part III 732
Walter C. Holmes

Dyestuff Tables 734

Editorials:
Misleading Claims for Imported Dyestuffs in Advertisements of Fast-Color Fabrics 736
Fast Fabric Standardization in Sight..... 736

The New German Dye Trust..... 737

Inquiry Department 738

Technical Notes from Foreign Sources.... 741

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Artificial Silk and the Textile Industry*

Cellulose the Raw Material—Nitrocellulose Process—Cuprammonium Process—Viscose Process—Cellulose Acetate Process—Strength of Artificial Silk—Humidity—Elasticity—Sizes—Dyeing Properties—Price Stability

By GUSTAVUS J. ESSELEN, JR.

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IT may seem almost like carrying coals to Newcastle for a man who is primarily a chemist to be here talking to a group of textile men on the subject of "Artificial Silk and the Textile Industry." I hope, however, that in the course of what I may have to say I can tell you a little about how the different kinds of artificial silk are made and the properties of the different varieties, with the hope that it may be of help to you as you meet these new products in your work.

The suggestion that there might be some connection between artificial silk and world exploration would perhaps at first sight seem a bit far-fetched, but there is a connection and it is a connection that binds together a great many new discoveries. The explorer, whether it is in science or geography, starts out to find one thing and often finds quite an unexpected thing. Columbus, of course, started out to find a short cut to India and instead he discovered the West Indies and America. When Count de Chardonnet began a noteworthy series of researches on the silkworm, its habits and the tree upon which it feeds, he hoped to discover the secret of producing natural silk by artificial means. Instead he discovered a wholly new and unexpected fiber known as artificial silk or rayon, and which has new and distinctive properties all its own. Now, just as we do not think of the West Indies, in spite of similarity in name, as a substitute or imitation India, no more should we regard artificial silk as a substitute for or imitation of real silk. It is a new fiber and we have got to recognize that and treat it as a distinct individual.

There are at the present time four general methods for the production of artificial silk, each dependent upon a different series of chemical reactions. The general outline of the process in each case, however, is the same. The raw material is cellulose. A very common raw material is cellulose in the form of purified cotton linters, which I have here [exhibiting samples to audience], and with which most of you probably are familiar. The other form is bleached sulphite pulp, which looks like so much thick paper. This cellulose, by one means or another, which I shall go into detail about subsequently, is converted into a syrupy liquid of about the consistency of honey and forced through minute orifices in a device called a spinneret. Many of you have probably seen these spinnerets, but for those who have not I will display one here [exhibiting], which was kindly loaned to me by Baker & Co., platinum merchants, who specialize in their manufacture. This particular spinneret is composed of about 80 per cent gold and 20 per cent platinum. I should like those of you in the front row to look particularly and see what a smooth surface there is on this spinneret. I showed it to some of the gentlemen seated with me here at the speakers' table, and they could not discern any openings in the spinneret when they looked at it. As a matter of fact, however, there are forty-four minute orifices in this spinneret, and they can be seen only if the spinneret is held up to the light in a proper manner. This is a device that is quite essential in the production of artificial silk.

The syrupy liquid is forced through the spinneret and then enough of the chemicals are removed so that a solid is formed again. Since this solid is continuously formed as the liquid emerges from the spinneret, it naturally forms a continuous filament, and that is the artificial silk.

The first successful process was that developed by Count de Chardonnet. It is known as the nitrocellulose process. This is a bare outline of the process: Purified cellulose, usually in the form of cotton linters, is treated

*An address before the meeting of the National Association of Finishers of Cotton Fabrics, September 29, 1925, at the Hotel Roosevelt, New York City.

with a mixture of nitric and sulphuric acids, forming cellulose nitrate. This in turn is dissolved in a mixture of alcohol and ether in order to form this liquid of honey-like viscosity, which is then forced through a spinneret, usually with only a single opening, into a stream of warm air. This evaporates the alcohol and ether, leaving nothing but the filaments of nitrocellulose. These skeins here [exhibiting] were made by that process.

Nitrocellulose Process

Nitrocellulose is akin to celluloid and is highly inflammable, and cannot, of course, be used for textile purposes as such. It has, therefore, to be purified by denitration, thereby eliminating the inflammable properties and giving us a regenerated cellulose in a new physical form. Chemically it is very much similar to the material that we started with. This, by the way, is the process used by the Tubize Company in manufacturing the Tubize artificial silk in this country.

You may wonder why I say "artificial silk" instead of "rayon," Well, it is partly habit and partly because, although rayon has met with a good deal of favor in the industry, it is not yet all-inclusive. We still have Celanese and Lustron, to mention only two; and for convenience I prefer to use a term that includes all of the artificial silks. I believe the Federal Trade Commission, however, objects to the term "artificial silk," but with your permission I shall continue using that term throughout my talk.

Cuprammonium Process

The cuprammonium process, I think, was next in historical development, and derives its name from the fact that cellulose in the form of purified cotton is dissolved directly in an aqueous solution containing both copper and ammonia. Hence the name "cuprammonium." That makes a beautiful blue solution, which is forced through similar spinnerets into a precipitating liquid, in this case usually sulphuric acid or caustic alkali. The silk that is being talked of quite a good deal now, known under the name of Bemberg silk, is a modification of this process. In this modification the solidification of the filaments is not conducted all at once. The filament is first gelatinized, so to speak, and then drawn out mechanically, so that by this means they are able to produce filaments about as fine as natural silk. After mechanically drawing it out, it is then conducted into a second bath, which completes the solidification.

Viscose Process

Probably the least expensive process for the manufacture of artificial silk and the most common is the viscose process. As raw material for this, either sulphite pulp or cotton linters may be used; in either case it is a purified form of cellulose. This is subjected to a caustic alkali solution of 18 per cent strength—and the time factor is important all along in this viscose process. After the removal of the excess alkali liquor, the cellulose is broken up into small particles and exposed to the action of carbon disulphide, which converts it into a gelatinous form soluble in water or weak caustic soda solution. All of these processes have to be carried out under very careful temperature control. The solution is then forced through the spinnerets, this time into weak sulphuric acid or sulphuric acid to which have been added various salts which have been found effective. As it leaves the coagulating bath it may either be wound on spools or led into so-called spin-pots, which revolve at the rate of 5,000 to 6,000 revolutions per minute. In either case it has to be skeined and purified from residual sulphur compounds and then bleached or not, as the case may be.

I have here various samples made by this process, furnished by three companies, the Du Pont, the Viscose and the Industrial Fibre Company. I think about 85 per cent of the artificial silk produced in this country last year was manufactured by this method.

Cellulose Acetate Process

The fourth method, as you know, is the cellulose acetate process. In its first stages this is chemically somewhat analagous to the cellulose nitrate process, though instead of nitric and sulphuric acids one uses a mixture of acetic acid and acetic anhydride. There is, however, a marked difference in the product, in that cellulose acetate is not inflammable like cellulose nitrate and, accordingly, when you once have your thread you can use it directly without taking out the acetate groups. As you will see later on, the fact that cellulose acetate silk is chemically a compound of cellulose rather than cellulose itself makes for a marked distinction in the properties of the first three varieties which I have mentioned and the cellulose acetate varieties. In some cases as high as 60 per cent of cellulose acetate silk is not cellulose but something else. I now show you some spools of Lustron cellulose acetate silk and some skeins and fabrics of Celanese. There is a distinction between those two owing to the fact that there are slightly different methods in each case of applying the mixture of acetic anhydride and acetic acid to make the cellulose acetate.

I would not want you to infer from this very brief discussion of the chemistry of these processes that chemistry is the only thing involved. It is, of course, true that artificial silk factories are often referred to as magnified chemical laboratories; and such they really are, because success is dependent upon unremitting chemical control at every step in the process. On the other hand, it would not be possible to turn out the uniform and satisfactory product which is being manufactured to-day were it not for mechanical developments of a very high order.

Now, as I have already hinted, the artificial silks that are to-day on the market fall into two general groups. The first group is viscose, the nitrocellulose (Tubize, as we know it), and cuprammonium silks. Chemically those are all regenerated cellulose and as such they are some-

what similar to each other—very much more like each other than they are like the acetate silk or anything else. However, as you all probably know from experience, there is just enough difference between those three varieties to make it a little bit uncomfortable if you don't know just which kind you are handling. Furthermore, it is also unfortunately true that artificial silks made by similar processes but not in the same factory will vary a little bit. To complete the picture, I will state that some years ago one lot of artificial silk made in the same factory sometimes would not act like other lots of silk made in the same factory, although that situation has happily been overcome to a large extent.

Now, the second group of artificial silks contains two varieties of cellulose acetate artificial silk: Celanese and Lustron. I shall have more to say about this group a little later, but I should like you to keep those two groups in mind.

Strength of Artificial Silk

One of the most interesting properties of any fiber is, of course, its strength. When we come to discuss strength there is quite a marked difference in the strength of these different artificial silks. In the first place, the strongest is the nitrocellulose artificial silk. Next comes the viscose, next the cuprammonium and next the acetate. That is their relative order of strength dry. The strength per denier will run about 2.5 for natural silk dry and about 1.5 for the nitrocellulose silk, which gives you a rough idea of the relative strengths of these varieties.

Now, as you all know, all artificial silk loses a large proportion of its strength when wet. Acetate silk, although it is one of the weakest in its dry condition, loses so very much less when it is wet that the two strongest silks—and they are just about alike when wet—are the nitrocellulose and the cellulose acetate silk. The way that is usually presented is that the cellulose acetate silk is far superior because it loses so much less of its dry strength when wet; but it is interesting to note that while this is true, yet, owing to the fact that nitrocellulose silk is so much stronger to start with, it and the acetate silks are about equally strong when wet. In fact, I learned just the other day that the nitrocellulose people have so much confidence in the wet strength of their product that they are experimenting with it for fishing lines. I do not know how that is going to work out, however.

Not only do these artificial silks—and particularly those of the first group—become much weakened when they are wet, but they stretch very badly if any considerable tension is applied. Now, this stretching, unfortunately, is a permanent proposition, and when the silk dries down it does not return to its original length. That means that the cross-section is very much reduced; and by that, of course, you weaken the fiber. That is something that has to be looked out for in all the finishing operations: to see that the fabrics, particularly those containing the first group of artificial silk, are not stretched when in the wet condition.

Humidity

As another direct consequence of this weakening of the fibers when the silk is wet, great care has to be exercised in the weaving and knitting operations. The humidity there, of course, is a matter of very great moment. With artificial silks of the first group the air must not be too damp; otherwise the stretching and distortion will be too marked. They tell me that the best results are obtained with a humidity around 65 per cent, which is probably a little lower than is ordinarily used for cotton. If, on the other hand, instead of the cuprammonium, viscose or nitrocellulose silks you are dealing with the second group—the acetate silks—you have got to operate at a very much higher humidity, or else your silk will be very brittle and will break. That is why so many concerns which had become used to the nitrocellulose, viscose and cuprammonium group, operating at around 65 per cent humidity, when they tried out the acetate silk were inclined to throw it out the window, because they had so much trouble from breakage. But if this difference is kept in mind there is no reason why acetate silk should not be used as freely as the other kinds. In fact, some of you may be interested in inspecting these samples which the Celanese Company kindly furnished me the other day.

Elasticity

I have a feeling that a good many of these things I am telling you are not new to you, but as they are a part of the story of artificial silk I am making mention of them. You have all probably heard about the first time a certain New England mill tried to finish a sample of cloth with rayon in it. It was a beautiful smooth sample to begin with, but when they got through with it they thought they had a seersucker, owing to the fact, of course, that not enough length was allowed in the artificial silk fibers for the taking up in the finishing process. A longer length is required in the artificial silk than in cotton. Another fact to be considered is that cotton will stretch, while artificial silk as a rule will not. In this connection it should be remembered that Celanese has a certain amount of elasticity, and you can take a Celanese thread and pull it out a certain distance, and it will spring back to its original length so long as it is dry. In weaving artificial silk, therefore, caution has to be taken to apply just as little tension as possible and still have the yarn lay flat.

Sizes

Now, as to sizes. The most common sizes of artificial silk are 150 and 300 denier. The limits of size that I think are available are as fine as 50 or 45 denier

and as coarse as 450 denier. In general, the finer the denier the higher will be the price of the yarn. Owing to the fact that nitrocellulose silk is so much stronger than the others, it is particularly adapted to the finer sizes; and, as you all probably know, the Tubize Company in this country specializes in the manufacture of the finer sizes, 50 to 80 denier. The samples I have here, and which you may inspect, are a colored skein of 80 denier and a white skein of 60 denier. Most of the other samples are 150 denier. Viscose can be obtained as fine as 80 denier, and some of these samples are as fine as that and Celanese as fine as 45 to 50 denier.

As I have already said, what appears to be a single thread as it comes from the spinning machine is really made up of a number of different filaments. At least one manufacturer of viscose puts out what is termed a "super-extra yarn." That yarn is made up of filaments of about 2½ denier each, as contrasted with about 6 denier for the average artificial silk filament. I am talking now of the individual filaments and not of the finished thread, which runs about 80 denier. One of the results of very fine individual filaments is to give an artificial silk which is very much softer and more pliable. At the same time, the covering power is increased; but, unfortunately, the wearing properties are not so good. The usual number of filaments, I might say, is between sixteen and twenty-four for the average artificial silk.

The softest and most pliable of the artificial silks is Celanese, and this makes it possible to weave a fabric that has a pleasant feel next to the skin, making it desirable for underwear. One other property that acetate silks have in general is that they are much better heat insulators than the silks of the viscose group; and that, of course, is also a desirable property for underwear. On the other hand, for fabrics where more body and stiffness are required, viscose and nitrocellulose silks are better adapted.

Dyeing Properties

So far as the dyeing properties are concerned, the artificial silks of the first group—viscose, cuprammonium and nitrocellulose—are much like cotton, except that the artificial silk of this group takes up the dye more rapidly. Accordingly, and as you all doubtless know, that means the necessity for more careful manipulation in the dye bath if even shades are to be obtained. Also, of course, the fabrics have to be handled as carefully as if they contained real silk—in fact, even a bit more carefully if broken filaments are to be avoided.

Now, cellulose acetate silks, on the other hand, are quite unique in their dyeing properties. In fact, it was some little time before satisfactory methods were available for the dyeing of cellulose acetate silks, but now both Lustron and Celanese are available in almost every shade. This red silk, as I have said, is Lustron [displaying skeins to the audience]. You can see a very nice line of dyed fabrics at the Chemical Show, and you will appreciate the wide variety of colors that can be secured when you inspect these samples of acetate silks which I have here.

The real reason for the unique dyeing properties of the cellulose acetate silks we do not know, except that it is related to the chemical composition of these silks—the fact that they are really cellulose compounds—"esters," as they are called—rather than regenerated cellulose. Chemically they are quite distinct from the silks of the other groups, and on this depends one of their most useful properties; that is to say, the possibility of cross-dyed effects with silk as well as with cotton, wool and other kinds of artificial silk.

There are several things that have to be looked out for, however, in handling cellulose acetate silks. One thing that must be avoided is the use of mineral acids. Mineral acids are very difficult to wash out, and when they remain in contact with the acetate silk there is a tendency to rot and decompose the fiber so that it falls to pieces. Also exposure to warm alkali is bad for cellulose acetate silks. On the other hand, although it may sound paradoxical, it is possible to take cotton fabrics that contain Lustron threads and mercerize them in the piece, provided the temperature of the mercerizing alkali is kept low. Fabrics containing viscose can be mercerized only under special conditions, because the alkali, even though cold, has a marked tendency to rot the viscose, and the same is true with regard to nitrocellulose silk.

Price Stability

A very interesting property of artificial silks in general is their comparative price stability. I wonder if you realize that artificial silk to-day is only about 11 per cent above its pre-war price, whereas wool has been estimated at approximately 133 per cent above its pre-war price, cotton 100 per cent and raw silk 68 per cent.

Artificial silk was first manufactured in this country in 1911, about fourteen years ago. At that time 320,000 pounds were produced by the Viscose Company. That is, as you see, roughly 1,000 pounds a day. Last year 39,000,000 pounds were produced in this country, or practically 130,000 pounds a day, representing an increase in that short term of years of 130 times, and this production was about 40 per cent of the world production of artificial silk. It almost took care of our domestic requirements, but not quite. Furthermore, it is estimated that the world consumption of artificial silk is almost twice that of natural silk. When the figures are stated in this way they seem very large, and it would appear at first glance that there is not room for much more; but if you look at it in another

way and realize that that consumption of artificial silk was only about 1 per cent of the consumption of cotton or 3 per cent of the consumption of wool, you can see that there is still plenty of room for expansion in this comparatively new industry.

Roughness of Dyed Silk Hosiery

By C. E. Bick,

Superintendent of Dyeing, Real Silk Hosiery Mills

EXCESSIVE chemical and mechanical action in silk hosiery dyeing causes the breaking of the silk filaments resulting in light colored, rough streaks on the goods. These streaks, although of light appearance, are composed of numberless raveled filaments, correctly called "fiocchetti" by the Italians. As they are formed of fibroin, they receive the tinctorial substances—as can be seen by microscopic examination—but they appear of a lighter hue on account of their extreme thinness, for the same cause that makes the dust of colored glass appear colorless, or gray the detritus of black marble, analogous also to what occurs with the foam of a colored liquid, which always results in a color less intense than the liquid itself.

The study of ravelings or lousiness in dyed silks is an old one. It has been discovered that many defects may occur in forming the silk fiber out of the two worm filaments, which in themselves could be divided into thinner threads. The purpose of this article is not to describe the forming of the silk fiber from the worm. These points are merely stressed to bring to mind that rough silk is an old problem and that various defects in construction cause breaking of the filaments when the silk is boiled off and dyed. Italian experts who have studied the situation, while abstaining from an expression of final judgment, assume that the tendency to ravel is a fault of the silk proper and that the dyeing manipulations only make it evident.

The dyeing of silk hosiery, no doubt, employs the most harsh mechanical dyeing action in the entire silk dyeing industry. Poor silk will break in a very short time when dyed in a rotary machine which is commonly used on account of its complete penetrating value. Even the best silk will become rough if run too long in a rotary or paddle wheel machine where mechanical action is greatest. It is the writer's personal opinion that when dyeing a heavy thread silk stocking—which will break much quicker than a lighter thread—the dyer should give his utmost effort to dye the goods as quickly as possible. If the goods begin to break, shade should be sacrificed to some extent in order to finish the goods in proper condition.

As for machinery, the Monel metal rotary and the Monel metal paddle wheel are the ones commonly employed to-day. Penetration is good with these machines and the mechanical action has been lessened recently in the rotary machine by using a higher liquor line in conjunction with a V-shaped compartment. This tends to cause the goods to float, thereby doing away with the tumbling action which eliminates to a great extent a large part of the friction as well as tangling. Nevertheless, the machine which gives practically no mechanical action or friction is the type in which the liquor is circulated through the goods by means of propellers, the goods remaining stationary. This machine is being used by some of the larger mills on account of its favorable frictionless properties, especially in redyeing at times when black is a poor seller. However, the best type of machine to employ varies greatly in opinion among dyers. The writer believes that, without a question of doubt, the machine that will dye successfully with the least amount of friction is the one that holds the greatest possibilities for the future.

Slashing

A Discussion at the Georgia Textile Operating Executives' Meeting

[Editor's Note.—*The following discussion of slashing problems appeared as part of the full report of the fall meeting of the Textile Operating Executives of Georgia, which was held at the Ansley Hotel, Atlanta, Ga., on September 15. The report of this meeting appeared in the October issue of Cotton, from which the discussion below is reprinted.*]

"WHAT is the best method of cooking size?" was the apparently well-worn question which began the slashing discussion. J. W. Hames, superintendent, Exposition Cotton Mills, Atlanta, Ga., was requested to explain his method. He said that he uses a closed kettle in this process, and cooks it under pressure. Responding to a query, he stated that they use no temperature regulation devices, but have a recording thermometer on the kettle, which is controlled by hand. He uses thin boiling starch and lets it stand for one hour under pressure. "How long do you hold it in the kettle before you put it down into your size box?" was asked. "We use small kettles so that we replenish the size in the circulating kettle as often as possible, and turn it down as soon as we get through cooking it," was the response.

"When you put your ingredients in the cooking kettle, do you put them in all at one time with the cold water?" asked the chairman. "We mix our ingredients in large tanks, with the starch, compound and everything, and a part of the water, and this paste is pumped into the tank and then the balance of the water is added and the steam is turned on."

"Do you break it up better by cooking it under pressure?" inquired Mr. Arnold. "We think we get better results from it, because we can control the amount of condensation better. We have a glass gauge on the side, and after it is cooked, if the condensation is not quite as much in one kettle as in another, we add a little more water to

bring it up to a point on the gauge," answered Mr. Hames, who added, in response to a further question, that he does not test for specific gravity or consistency.

"Does anyone control the temperature in cooking; or do you just open the valve and bring it to a boil?" was the chairman's next general question.

"We bring it up gradually about twenty minutes, and then after the agitation it is opened wide," said Mr. Howarth. "I should say it comes up to about 150 degrees before it is wide open."

W. L. Phillips, superintendent, Social Circle (Ga.) Cotton Mills Company, was requested for his experience and stated that "we have our slashers fully equipped with controls, the cooking kettle, the storage kettle, the size box and cylinder. We open the steam wide open at 75 pounds pressure, and in fifteen minutes it is 212, and this control holds it at 212, or whatever we set it at, for one hour and fifteen minutes. We use thin boiling starch. We have used it for years, although I have never been convinced that it is equal to thick boiling."

"We use pearl starch with 75 per cent water, and bring it up to 180 degrees for thirty minutes, and then bring it up to a boil," said Mr. Wilke.

"Why do you do that?"

"In order to convert the starch from pearl to thin boiling form through the use of arcy," explained Mr. Wilke.

At this point Mr. Arnold outlined some experiments which had been carried out in his own organization. "We find," he said, "that a great deal depends upon how quickly or how slowly you bring the temperature rise up from the cold batch to the boiling point. It makes quite a little difference. In one of our plants, where we were using 110 pounds of thin boiling starch and getting certain results, we opened the valve and brought it up to the boiling point as quickly as we could. After regulating that temperature rise from the cold batch to the boiling point, letting it take forty minutes to come to a boil, we found that we could cut down to 95 pounds of starch and get a much better and a smoother starch, with more adhesiveness. We found it best to hold it for twenty minutes after bringing it to a boil.

"On the thick boiling starch we took one hour to bring it to the boiling point and then held it for fifteen minutes.

"By controlling the temperature rise in this manner on thick boiling starch we have gotten as good results as with the thin boiling and, of course, use much less starch.

"It's the same principle as cooking a cake. Your wives who know how to cook cakes don't get the stove red-hot and then stick the cake in the oven. It would fall or sag in the middle. You must watch the temperature. In cooking size you must break down that starch cell and expand it until it will take up the proper moisture content. If you don't it will be just like it is when you pour a bunch of starch into water. It will lump up; and if you will take those lumps out and break them up and examine them under a microscope you will find that they have formed capsules, and there is a dry section inside of those capsules."

As to how he put on the same percentage of size after reducing the amount of starch, Mr. Arnold answered a question by stating it was due to a better penetration of the size into the yarn. The compound must, of course, be regulated, as well as the speed of the slasher. He added that, in his opinion, by cooking thick boiling starch correctly, controlling the temperatures and taking the proper length of time to bring it to a boil, equal results could be secured on thick boiling starch as on thin boiling, with less expense in the total sizing cost.

Mr. Wilke explained a system of shutting the main valve to the size kettle and using a little by-pass, which brought the size to a boil gradually.

About the same amount of shedding on thin and thick boiling starch was reported by Mr. Arnold in response to a question.

"I believe we will find in proper regulation or control of the cooking of size that, regardless of the starch you use, shedding will be largely controlled; that is, if the starch is properly cooked you will get less shedding," declared Mr. Thompson, of Trion. "Most of us can go to a slasher and rake it and find particles of starch unopened. If that has been properly cooked and given time enough I believe it is possible to open all the starch and get it on the yarn and cut down shedding, and by so doing we will get the same weight with less poundage."

"That has been our experience," declared Mr. Arnold. "You break down the starch cell and get it more thoroughly into solution, and you will necessarily have less shedding."

"I wonder if it is a fact that some mills really cook the size too much," suggested Mr. Anderson. "You know, fifteen or twenty years ago the common method was undercooking; but the mills began gradually putting in additional kettles, and I think the majority began cooking the size sufficiently, and then cooking it too much. Is there any danger in cooking size too long?"

Howard J. Files, A. E. Staley Manufacturing Company, Decatur, Ill., was requested for an opinion, and stated that "I believe there is not much danger in cooking size too much provided you have cornstarch and the proper sizing compound. You can cook potato starch too much. Cornstarch will stand boiling, and I believe there is more danger in not cooking it enough than in cooking it too long."

Mr. Arnold asked his opinion as to the best way to bring size to a boil, and the chemist replied that in his opinion the important point to watch is the time after the size is brought to a boil.

"Well, suppose we have a thick boiling starch and it takes an hour to bring it to a boil—would it be better to do this, or bring it up in twenty minutes and hold it at boiling for an hour?" continued Mr. Arnold.

"I think it would be better to bring it up in twenty minutes and hold it for an hour," was the reply.

"What would be the proper length of time to cook

(*Continued on page 744*)

What the Chemical Industry of the Country Means to the Chemical Warfare Service*

Chemical Industry Factor in National Defense—Chemical Warfare Service and Dye Industry—Germany's Military Asset—Contracts for Chemical Wafare Abolition—Humanity of Chemical Warfare

By MAJOR-GENERAL AMOS A. FRIES

Chief Chemical Warfare Service, Washington, D. C.

THE subject assigned to me for this task is "What the Chemical Industry Means to the Chemical Warfare Service." I am going to take the liberty of broadening this subject a little bit, because I think that by so doing I can better point out to you what the chemical industry means to a nation and what should be done to insure that this industry be maintained.

The principal reason for the existence of the Chemical Warfare Service is to insure that this country will at all times be prepared to utilize chemistry in all its phases for defense against an enemy. We are also very much interested in the development of chemicals which heretofore have been used only in war for peacetime uses. If uses for these chemicals are developed and increased it means that a commercial supply of chemicals for war time is constantly available.

What the chemical industry means to the Chemical Warfare Service, therefore, is only another way of saying what this industry means to the entire nation. The vital necessity of a well-developed chemical industry must be impressed upon the American people at this time. The industry is now undergoing a very critical period in its history. The unlimited demand for chemicals caused by the World War is passed; tariff reduction is steadily increasing, and foreign competition is growing more and more menacing.

Prior to the World War industrial chemistry was very largely confined to Germany, and the United States was one of Germany's best customers. The sole hope of Germany regaining her formed place as a world power is through her highly developed and splendidly organized chemical industry. However, she now has a commercial rival in the United States. Our chemical industry not only takes away from Germany her American trade, but also competes with her in foreign markets. This being the case, no effort will be spared by her to stifle development of America's new chemical industry by any possible means.

The forty years' start that Germany has over this country in industrial chemistry is a tremendous advantage. This does not mean that Germany can turn out any better products than American industries, for as a matter of fact the German products are in practically every case identical with the American products. It does mean, however, that Germany can manufacture these products more efficiently and at a lower price. This is partly due to the difference in the cost of labor between Germany and the United States, but still more is it due to the fact that Germany has from her years of experience developed a technique and a body of technical personnel that we cannot yet duplicate in this country for a number of years.

Heretofore the American chemical industry has been aided by a high protective tariff and by making available to it the German chemical patents which were seized during the World War. The tariff is now being gradually lowered year by year, and this fact alone will require all the resources and ingenuity of the industry to keep going in the face of German imports which are made possible in constantly increasing quantities owing to this lowering of tariff.

There has also been made an attempt to take away from our chemical industry the seized German patents and return them to their former owners. If this is accomplished it will mean a complete extinction of our organic chemical industry and that would indeed be a tremendous national calamity. This proposal has met with but very little opposition with the American people in general, but I am convinced that the reason for this lack of opposition is that they do not realize the serious consequences. To the non-technical mind it seems like a fair-minded and generous thing to do to return to a former enemy his patents, now that the war is over and its military need for them is passed. They fail to realize that the chemical industry has in recent years become so vital in national defense that no nation could successfully defend itself against another first-class power without a well-established chemical industry. I desire to express in strongest terms my sincere appreciation of that ardent patriot, Francis P. Garvan, who has stood practically alone and unaided in defending the chemical industry of this country against the attempt to take away from them the German patents, which attempt has been made by very powerful influences in this country backed by the almost unlimited resources of the German chemical trusts.

Chemical Industry Vital Factor in National Defense

I shall now try to explain, as well as I can in this brief talk, why the chemical industry is such a vital

*An address delivered before the Fourteenth Annual National Safety Congress at Cleveland, Ohio.

factor in national defense. In the first place, I am sure that you all realize that chemistry now plays an important part in practically all industrial effort. The steel industry, the clothing industry, the petroleum industry and other basic industries which are not chemical industries in themselves, all employ chemists in large numbers to test, supervise and control their various processes. Similarly, in the manufacture of munitions the hand of the chemist is seen in practically every finished product. The art of war has now become so complex that not only are highly specialized materials required but, in addition, hundreds of thousands of commercial commodities of every known description are needed. The experience of the World War demonstrated that men can be mobilized and trained at a faster rate than equipment for them can be provided. Procurement of munitions has become the limiting factor in the military efforts of a nation. This fact has served to nationalize war. Wars are no longer fought by the armed forces alone. Industry must be mobilized the same as men. Essential industries must be increased and stimulated to maximum output, while non-essential industries must be converted to the manufacture of essential items or else their activities must be severely curtailed.

This necessity for industrial mobilization is now generally recognized by the supply branches of the Army and Navy. It is something which cannot be put into effect in a moment's notice. No industry can instantly change from peace-time production to war-time production of the same or different items in tremendously increased quantities. There will always be some delay in any case, but this delay can be greatly decreased by studying the problem in peace time and preparing a well-defined plant which will at once become operative in time of war. We had no such advance plan at the outbreak of the World War. As a consequence, it was over a year after our entrance into the World War that the American industry began to make itself available, and as a result only a negligible quantity of American munitions ever reached the fighting front in France. We have profited by this mistake and we are now engaged in determining what we want, how much we want and where we want it in the event of a future war. Then, we are determining where this material can be obtained. As a result, if we are engaged in another war the industry of this country will know in advance what its mission is and can immediately take steps to mobilize for war production.

The chemical industry plays a most important part in this planning for industrial mobilization. Practically all branches of the Army which handle supplies require very large amounts of chemicals of every conceivable variety. For example, many different kinds of metals are used in the manufacture of guns and shell. Nitrates, acids and various solvents are used in the manufacture of explosives. In addition to these, many different chemicals are required by the Ordnance Department for experimental and control work. Thousands of different chemicals are required by the Medical Department in the form of drugs and pharmaceuticals. Several chemicals are used in large quantities by the Air Service in airplane manufacture. The Signal Corps uses chemicals in great quantities for photographic purposes.

The Chemical Warfare Service is undoubtedly the most vitally interested of all branches of the Army in the chemical industry. We shall require the services of practically all the well-known chemical firms in the country. There is practically no chemical produced in large amounts in this country that does not enter into some stage of chemical warfare manufacture. It is true that nearly all of our finished products are manufactured in Government plants. This is necessary because of the toxic properties and the dangerous nature of chemical warfare material. This manufacture must be carried out under strict military supervision so as not to endanger the lives of the civil population in the event of accidents. It is also necessary because these finished products are so highly specialized that very few firms in this country are properly equipped to undertake their manufacture. These Government manufacturing plants, however, are, strictly speaking, assembling plants. This is to say, only the last step in the manufacturing process is carried out there. This last step usually converts a perfectly harmless intermediate chemical into a highly toxic finished product. The intermediate, however—and there are sometimes several for each finished product—are furnished and manufactured by civilian chemical firms. These intermediates are often chemicals of very complex chemical structure, and can only be manufactured by firms that have brought their equipment and personnel up to a very high degree of efficiency.

In addition to these intermediate chemicals, vast amounts of what might be called basic chemicals are also manufactured for the Chemical Warfare Service by the chemical industry of the country. By these basic chemicals I mean such things as acetic acid, alcohol and benzol. These chemical industries which manufacture this type of product will be faced with a tremendous problem in the event of a future war, because they will have such large demands not only from the Chemical Warfare Service but from several other supply branches of the army and navy.

Chemical Warfare Service Deeply Interested in Dye Industry

There is one chemical industry in which the Chemical Warfare Service is especially interested—this is the dye industry. This industry possesses potentialities of such vital national importance that it is well worth our special consideration for a moment. Dyes are almost without exception chemicals of very great complexity in structure, requiring difficult and complicated processes in their manufacture. In a well-

equipped dye factory there is probably the most intricate and complicated set of apparatus of any factory that has as yet been developed. There are several hundred well-known organic dyestuffs, any one of which a manufacturer may be called upon to produce. This means that his plant must be equipped to manufacture not only very complex chemicals but also a large number of different products.

This means that a dye factory is unusually well equipped to turn on short notice from the manufacture of one chemical to another of quite different structure and properties. Now, it is a remarkable fact that chemical warfare intermediates and sometimes even our finished products are very closely related structurally to dyestuffs. Sometimes the dye intermediates and the chemical warfare intermediates are identical. By the employment of a different final operation either a pretty color or a poison chemical is produced as desired.

High explosives are not so closely related to dyes as chemical warfare products are, but so great is the flexibility of the dye industry that even high explosives can be produced by it in large quantities with only minor changes in plant lay-out and equipment. A well-established dye industry may therefore be aptly termed a potential arsenal.

This fact was clearly realized by Germans during the World War and, in fact, her dye industry was what kept Germany going as long as she did. At the outbreak of the war the German dye plants were not utilized for war purposes, but continued their peace-time production. This was because the Germans expected to win the war in a few months and they wished to have a large supply of dyes and other chemicals on hand so that they could at once resume their dominance over the chemical markets of the world. When the Germans failed to accomplish this abrupt termination of the war, a serious munitions crisis occurred in Germany. The dye plants were then called upon for assistance and they certainly met the crisis in a magnificent manner. Within six weeks after ceasing normal peace-time production the Leverkusen works of the Bayer Company were turning out TNT at the rate of several million pounds per month.

When chemical warfare was initiated by the Germans in the spring of 1915, it was the dye industry that made this possible. All chemical agents used by the Germans were developed in the laboratories of the dye factories by their research staff and manufactured in their factories. It should be further emphasized at this point that this manufacture was accomplished with only very minor changes in machinery and equipment.

Germany Has Preserved Greatest Military Asset

Immediately after the cessation of hostilities these plants at once resumed their peace-time manufacture of harmless dyes and the Germans have been loudly proclaiming their peaceful character ever since. The Germans have been successful in preserving their greatest military asset, which is also their one hope of regaining prominence as a world power—their great chemical and dye industry. I am sure that you can readily appreciate why the Chemical Warfare Service is so vitally concerned over the future of the dye industry in this country. Prior to the World War the dye industry was in a very undeveloped stage in the United States. Nearly all the factories then in existence produced only the cheapest and lowest grade dyes. The few that did produce dyes of a better grade obtained all their intermediates from Germany and were therefore entirely subject to German domination. The advent of the World War, however, shut off the supply of high-grade dyes to this country and enabled American manufacturers to attempt to duplicate the German processes without fear of foreign competition. An enormous amount of research and experimentation had to be carried out in order that our chemists might learn the German technique which was developed over a period of forty years. The seizure of the German patents was an enormous help, of course, but this did not overcome the problem of developing a plant set up and a skilled personnel. In spite of this difficulty, by the close of the war the American dye factories were turning out products which were identical with the highest grade German dyes. This, I claim, is one of the most remarkable accomplishments ever attained by the chemical profession of this country.

Let me now emphasize again what I said at the opening of this talk. We now have a young and growing chemical industry in this country. The chemical industry is a vital factor in national defense, especially the dye industry and other synthetic chemical manufactures. These industries were developed as a result of the World War when the German supply was cut off. We have succeeded in duplicating the German products, but not as yet at German prices. It is impossible to accomplish in six or seven years everything that Germany has accomplished in forty years. This young industry must have further experience without fear of annihilation in order to so increase their efficiency that they approach the prices now quoted by German manufacturers. Germany looks upon our chemical industry as a great commercial menace. She will do anything to keep it down. The next ten years will decide the matter. If our industry can be kept going during that period of time they should then have developed to a point where they can stand German competition; provided, of course, a reasonable tariff exists to equalize the difference in labor costs. On the other hand, if the industry is not encouraged and protected the Germans can flood this country with high-grade dyes at much cheaper prices. In fact, they can sell at a loss for a few years if neces-

sary and force our domestic industry out of business. This would deprive the country of both a tremendous commercial power and a vital factor in national defense. It must not be allowed to happen.

The old alchemist's dream of making gold from baser metals remains a dream no longer. We know it can be done; exactly how to do it with various substances has not yet been worked out. Enough, however, has been done to know that if you can change in any given substances the proper number of electrons revolving around the center mass in the atom, you can change from one material to another. The fundamental possibilities are inconceivable at the present time.

This is quite an excursion away from the subject. It seems desirable, however, to put down from time to time something of the extent of chemical development to-day. When once that is thoroughly realized, there comes a further realization that chemistry is so much a part of our daily lives that it is bound to be used in every possible way in war. That again leads us to the various proposals which have been made in the past five hundred or more years to abolish the use of powders, explosives, gas and other materials from use in war. Every attempt at such abolition has ended in failure. When men or nations are fighting for their lives, they are going to fight with what they know best how to handle and which best promises success. We may talk in all the circles we want and in the four directions of heaven, and we will still always come back to that human fact.

In 1899 the nations of the world met in the Hague to discuss subjects which had been proposed for discussion. One of these was the attempt to abolish by treaty certain forms of warfare, including asphyxiating or gas shell. Secretary Hay, with an understanding excelled by none of human nature in peace and war, gave the following instructions which every American should know:

"The expediency of restraining the inventive genius of our people in the direction of devising means of defense is by no means clear; and considering the temptations to which man and nations may be exposed in a time of conflict, it is doubtful if an international agreement to this end would be effective. The dissent of a single powerful nation might render it altogether nugatory. The delegates, therefore, are enjoined not to give the weight of their influence to the promotion of projects the realization of which is so uncertain."

The chairman of the American delegation to that convention was our most famous naval author, the late Admiral Mahan. He followed the wise words of Secretary Hay, adding thereto his own comments when the Hague Convention passed a resolution reading as follows:

"The contracting Powers agree to abstain from the use of projectiles, the sole object of which is the diffusion of asphyxiation or deleterious gases."

In the discussion following the passage of that resolution, Admiral Mahan said:

"The objection that a machine of war is barbarous has always been raised against new weapons which were nevertheless finally adopted. In the Middle Ages it was firearms which were denounced as cruel. Later, shells, and more recently torpedoes, have been denounced. It seems to me that it cannot be proved that shells with asphyxiating gases are inhumane or unnecessarily cruel machines of war, and that they cannot produce decisive results. I represent a people that is animated by a lively desire to make warfare more humane, but which may nevertheless find itself forced to wage war; therefore, it is a question of not depriving itself through hastily adopted resolutions of which it could later avail itself with good results."

Says United States Alone Kept Faith

Admiral Mahan refused to sign for the United States. The delegates of Great Britain and Germany followed his lead and also refused to sign. However, in the next few years both Great Britain and Germany signed. Without taking more time, let it be said that in the World War every nation in the world that promised not to use gas broke its treaty to use gas. The United States alone in using gas kept its faith. It refused, under the leadership of Secretary Hay and Admiral Mahan, to attempt to do the impossible. Gunpowder and muskets were outlawed by every power on earth a few hundred years ago, including the Pope of Rome, who maintained that he had authority over all the rulers of the world. Neither the Pope's authority nor that of kings and princes availed to stop the use of gunpowder.

In the winter of 1921-22 a conference of Powers meeting in Washington, which meeting has since become known as the Washington Arms Conference, drew another agreement to abolish the use of gas in war. That agreement provided that before it could become effective each of the five powers signing it must ratify it and their ratifications be deposited in Washington. Inasmuch as it has not been ratified by all five, it is not in effect and the United States is to-day in the fortunate position of not being bound by any treaty whatever to limit its use of chemicals in war.

The time of the National Safety Council is being taken to bring this matter as clearly as possible before you. Why should the United States blind its eyes by a treaty that can only result in seriously weakening national defense, besides laying the nation open to a surprise attack by this most powerful of all materials —a surprise attack that will only be made when some nation believes it can win a sure victory by springing gas on us at the most inopportune time?

The United States should do nothing that will change the fortunate position in which the Congress

placed it on June 4, 1920, when it created the Chemical Warfare Service, with wide powers in research, development, manufacture, purchase, supply and training of the Army in chemical warfare, both offensive and defensive. That law passed by Congress and approved by the American people should remain unhampered. If the United States is worth having it is worth fighting to save. If it is worth fighting for it is worth using every bit of power available to make the fight a success.

There is no question of the power of chemicals, usually referred to as gases, used directly in war. The Germans used gas in a poor and small way, even toward the end of the war, compared with the way it can be used in the future; and yet in that poor and small way the Germans imposed on the Americans twenty-seven casualties with gas out of every one hundred casualties produced by all weapons of war. To put it another way, with perhaps 5 per cent of her material gases, she achieved over 27 per cent results. That fact is known to every military organization in the world. It will never be forgotten and never lost sight of.

Humanity

And this brings us to another point. Because Germany sprung gas on a startled world, and further because she achieved such remarkble success with it, every effort was made to convict Germany of greater barbarity than wars were supposed to allow. The wounds being mostly inside the lungs, where their nature was difficult to determine by any known methods, the wildest stories were told concerning the nature of these wounds. We were led to believe that the lungs were eaten out as the tuberculosis germ eats out the lungs. In fact, nothing too wild or too fantastic could be applied to chemical warfare.

Those fighting at the front, particularly the Chemical Warfare Service and the Medical Corps charged in order with the prevention of gas casualties or the cure of the gas wounded, began to see the truth before the war closed. That truth is that while more than twenty-seven out of every hundred casualties were caused by gas, only two of each hundred gassed died. On the other hand, of the tens of thousands struck by bullets, shells, bayonets and bombs, twenty-five per hundred died. Contrary to the wild tales of the war, then, the man who was gassed had twelve times the chance of living and coming home to father, mother, wife and children, than did the man struck by bullets, shells, bayonets and bombs.

And then there was spread the wild tale that sooner or later the man gassed would die of tuberculosis. And what are the facts there? The most careful searching of hospital records and individual reports of sufferers from gas show that practically none of them whatever have any after-effects; indeed, the medical profession is beginning to believe with Dr. Francine of the University of Pennsylvania, who said that the man who had been gassed, if he ever took tuberculosis, would take it less quickly, it would progress less swiftly and less severely than if he had never been gassed.

Safe Methods of Boiling Starch*

Recommended by Corn Products Refining Company

IT was recently brought to our attention that, in the opinion of some of the representatives of the textile industry, the boiling over of contents of kettles was more frequent when thin boiling starch was being treated, and that little or no trouble was experienced when thick starch was being boiled.

This subject has received, for a considerable length of time, serious consideration on the part of our chemical department, and on account of being closely in touch with the textile industry it has been readily agreed by all that starch kettles frequently boil over, causing accidents, and that this is likely to occur more frequently with thick boiling starch than thin boiling starch.

Recently our attention was called to tentative regulations that were being prepared wherein it was stated that the revolving blades of the agitator in the kettles should be turned in such a direction as to cause the starch to be impelled downward.

In our opinion, if the paddles are not properly covered with the starch paste there will be a splashing effect, regardless of what the direction of the inclination is, and we believe that the splashing and boiling over are due more to the injection of the steam than to the direction of the paddles.

Reference is also made in the tentative regulations to the effect that the best practice is to keep the cover on the kettle tight at all times when the steam is on, and not to remove it until the steam valve has been closed. We believe that it would not be practical to observe this regulation in practice, because it is necessary for the operator to look into the kettle from time to time to observe the boiling process, unless some other means is adopted whereby the cover can be kept in place and the boiling operation observed by the operator.

To overcome this condition, we believe that safety valves or opening vents should be provided to allow steam to escape, providing the boiling kettles are kept closed tightly; and we believe that the boiling can be regulated safely and advantageously if the following facts are taken into consideration:

We believe that the main cause of starch kettles boiling over is due to the fact that the steam is usually supplied by a ¾-inch steam line provided with a valve of corresponding size. This size is usually selected in order to bring the mixture to the boiling point as rapidly as possible, and the custom is to use a fully supply of steam. There is, of course, no danger of boiling over until the paste has reached the boiling point; then it is customary

*Paper read before the National Safety Council Convention, Cleveland, Ohio, September 30, 1925.

for the operator to make the steam adjustment. This is very difficult to do, because a very slight movement of the valve makes a great difference in the amount of steam admitted. Also, the vibration tends to open the valve and the valve does not remain set for proper and safe boiling.

This difficulty can be eliminated by by-passing the ¾-inch valve with a ¼-inch by-pass provided with a ¼-inch valve; then, when the boiling point has been reached the large valve is to be closed completely and the boiling regulated by the small ¼-inch valve. It has been found that this valve may be opened full without danger of boiling over. Furthermore, size ingredients which are added to the size kettle in addition to the starch, particularly soapy and alkaline materials, promote foaming. As a final precaution, the amount of paste prepared should be so regulated that the level of the contents in vessel is from 4 to 6 inches below the top of the kettle. This will permit ample room for the agitation of the mixture and elevation of the surface, which always occurs during the boiling process.

We sincerely trust that the thoughts mentioned, if adopted by the industry in whole or in part, will materially assist in eliminating the troubles encountered because of the boiling over in closed vessels, and we again wish to impress upon the representatives of the textile industry present that they closely observe the boiling process, particularly when thin boiling starch is being boiled, and we believe that by so doing they will be convinced that thin boiling starch causes less trouble in the respect outlined than thick boiling starch. We would gladly co-operate with any committee organized for the purpose of conducting additional research work with the intention of preparing regulations to cover the prevention of boil-over troubles.

COLORS FOR SPRING ISSUED

The Textile Color Card Association has just issued the latest advance seasonal forecast to its members in the form of the 1926 Spring Card.

One hundred colors are shown, of which twenty-two are devoted to woolens. A special collection of crayon or pastel colors, simulating those used by famous beauties of the French courts of the seventeenth, eighteenth and nineteenth centuries are portrayed.

Another feature is a group of modernistic colors inspired by the Paris Exposition of Industrial Arts and representing the salient colorings in the art exhibits and the chromatic treatment in various forms of decorations.

Several new and interesting shades of bois de rose are stressed, also new interpretations of rose beige, buff and blond tones, strawberry, raspberry and old wine reds are introduced, also novel varieties of blue lavender and violet-tinted and grayish blues. Among the greens are Chartreuse, absinthe and other yellow-toned shades. Pinks, corals, salmon, rose and brilliant yellow-reds are given, also new tonalities of plum, Russian violet, old lilac and orchid shades. Light and medium wood browns, burnt almond and honey tones are represented in several gradations.

The colors portrayed cover a wide range and represent the general fashion trend for millinery and garments. The shoe and hosiery spring forecasts will appear later on special cards. The association will release the spring card for general distribution about November 15.

EXPORTS AND IMPORTS OF COAL-TAR COLORS AND CRUDES

Statistics covering exports and imports of coal-tar colors and crudes during the month of August have just been issued by the Department of Commerce. Exports of intermediates and finished products during August were as follows: Aniline oil and salts, 63,870 pounds, valued at $13,941; other intermediates, 62,934 pounds, valued at $11,151; coal-tar colors, dyes and stains, 2,205,476 pounds, valued at $535,093. Exports of crudes were: Benzol, 7,191,834 pounds, valued at $268,329; crude coal tar, 14,960 barrels, valued at $30,732; coal-tar pitch, 1,256 barrels, valued at $4,003.

Imports of coal-tar crudes during August were as follows: Benzene and toluene, 143,114 pounds, valued at $3,663, the bulk of which came from Mexico; creosote oil, 3,992,418 gallons, valued at $498,993; tar and pitch, 1,253 barrels, valued at $6,761; pyridine, 89,215 pounds, valued at $48,269; all other coal-tar crudes, 63,591 pounds, valued at $7,503; other intermediate products, 197,724 pounds, valued at $97,171. Imports of alizarine, Indigo, colors, dyes, etc., and other coal-tar products were: Alizarine and derivatives, 15,505 pounds, valued at $42,227; Indigo and Indigoids, 439 pounds, valued at $391, all from France; colors, dyes, stains, etc., 409,235 pounds, valued at $476,737; vegetable extracts for dyeing, coloring, etc., other than tanning, 395,925 pounds, valued at $24,925.

The plant of Cupra, Inc., at Clifton, N. J., which abandoned the attempt to manufacture rayon on a commercial scale several months ago, is soon to be reopened, according to rumors current in the New York market. It is believed that the Doherty silk interests, original operators of the plant, are behind the new venture. In the attempt to operate about a year ago, the cuprammonium process was tried. Failure was ascribed at the time to the relatively high cost of the original cuprammonium process, coupled with insufficient capital. A few months after operations were suspended, the Atlas Powder Company, it was understood, obtained an option on the property of Cupra, Inc., and after considerable experimentation, produced some yarns on a laboratory scale. This was about six months ago. Later it was reported that the Atlas company allowed its option to lapse. It is understood now that the new attempt may be made on a viscose basis.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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ANNUAL MEETING OF THE SOUTHERN SECTION

The annual meeting of the Southern Section of the American Association of Textile Chemists and Colorists was held October 10, 1925, at Greenville, S. C. The meeting was opened with dinner at the Poinsett Hotel.

In the absence of H. M. Chase, chairman, Malcolm Mackenzie, vice-chairman, presided. Brown Mahon, vice-president of Judson Mill, welcomed the members and guests to Greenville.

R. W. Arrington, superintendent of the Union Bleachery, Greenville, S. C., read a paper on "The Dyeing and Finishing of Cotton Fabrics Containing Rayon."

The Vice-Chairman next introduced Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers Association, who addressed the Section on the American dyestuff industry, relating to the Government's policy to the industry, and problems confronting the industry. Dr. Herty stated that the progress in the industry resulting from work in the laboratory was great, but that the present problem was work outside the laboratory.

Changes in the international tariff situation which will necessitate production of better and cheaper products in the country, especially in the South, were stressed by the speaker, who gave statistics from a tariff commission report. Germany is asking for short term loans to be changed into long term loans, and tariff rates on goods be lowered so as to enable her to pay her debts. This brings up a problem that the country must face and solve for itself.

The matter of graft in the dye industry was discussed by the speaker, who stated that it was one of the most serious menaces existing to-day. This has been made possible by lack of interest of the legislators, he pointed out, and he urged members of the association to join in educating the rising generation of dyers in such manner that this practice would be wiped out.

The necessity of the association was spoken of by Dr. Herty, who said that one of its chief services was in giving opportunity for persons to get together and discuss their problems in a friendly manner. In conclusion, the speaker told of the bright future lying ahead of the industry in this country and urged all members to make most of the manifold opportunities before them.

As this was the Annual Meeting, officers were elected for next year. Leonard Little, general manager of the Pacific Mills, Lyman, S. C., was elected Chairman. Charles E. Stone, General Dyestuff Corporation, Charlotte, N. C., was elected Vice-Chairman. M. T. Johnson, Judson Mills, Greenville, S. C., was elected treasurer, and H. W. Ormand, Union Bleachery, Greenville, S. C., was elected secretary.

The following members were elected on the Sectional Committee: H. M. Chase, Riverside & Dan River Cotton Mills, Danville, Va.; P. O. O'Neill, Chattanooga, Tenn.; Tom Taylor, Newnan, Ga., and Arthur G. Thompson, Charlotte, N. C.

The next meeting place was discussed, but it was decided to leave this matter in the hands of the Sectional Committee.

The Secretary was instructed to thank L. P. Hollis of

the Parker School District for the use of the school's moving picture machine.

Dr. E. H. Killheffer, of the Newport Chemical Works, Inc., and Dr. Walter M. Scott, of Cheney Bros., were present representing the National Council. Dr. Killheffer stated that as soon as twenty-five members in the South voted to establish a new Section there, the action would meet with the approval of the Council. Both Dr. Killheffer and Dr. Scott expressed the opinion that it would be best not to divide the Section until a larger membership could be secured.

The Secretary was instructed to write the Council through the National Secretary extending an invitation to hold the annual meeting of the American Association of Textile Chemists and Colorists in 1926 in some Southern city.

A rising vote of thanks was given R. W. Arrington for his paper and to Dr. Herty for his address.

H. W. Ormand, Secretary.

The Bleaching, Dyeing and Finishing of Cotton Fabrics Containing Rayon*

By R. W. Arrington
Superintendent, Union Bleachery

The processes of bleaching, dyeing and finishing of cotton fabrics containing rayon are not dissimilar to the processes employed in the bleaching, dyeing and finishing of all cotton fabrics. Therefore, if one expects to hear with this paper a technical discussion of bleaching and finishing, I am afraid he will be disappointed. As a commission finisher, my thoughts naturally run along the lines embracing the converter, the gray mill and the finishing plant. Even though that is the case, anything I might say would be equally applicable to a concern which does its own designing, manufacturing and finishing. In the latter case this concern would have all of the problems encountered, instead of those encountered by each one of these three groups.

The phenomenal development of artificial silk, or, as it is now called, "rayon," in the last few years makes it almost impossible to treat a subject of this kind in a broad way because of the vast multitude of fabrics and combination fabrics made wholly or partially of rayon. Different patterns or different fabrics might take slightly different treatments, due to the nature of the fabric and to the use to which the particular fabric will be put. I believe, however, a cotton shirting or underwear fabric containing rayon stripes will be sufficiently representative to enable us to derive some good from a discussion of the bleaching, dyeing and finishing of this particular fabric.

In this day and time it is becoming more and more necessary for each person in the chain of distribution to understand more thoroughly the problems that others in the same chain encounter; especially is this true in the handling of cotton fabrics containing rayon. There is a decided responsibility on the part of the converter, the gray mill and the finishing plant, and the proportionate part of this responsibility must be fully and cheerfully shouldered by each one if the best finished results are to be secured. It is my opinion that in the production of the proper finished article the responsibility on goods containing rayon lies about one-eighth with the converter, three-eighths with the gray mill and one-half with the finishing plant. It seems to me that that is about the way it lines up to-day, which means that the manufacturer of the rayon itself is entirely left out of the problem. I am not sufficiently familiar with the operations in the rayon manufacturing plant to state what his responsibility should be, but certainly it is reasonable to suppose that he has troubles and bad work of one kind or another, due to temperatures getting too high or too low, or to acid baths getting too strong or too weak, or in other ways which would cause his product possibly to look all right but to have certain defects which would not show up until the goods were subjected to chemicals used in the process of bleaching. As that, however, is a responsibility which cannot be definitely fixed at this time, certainly not by me, we must leave that feature entirely out of our consideration and think only of the converter, gray mill and finisher.

A person may ask, in what way does the converter enter the problem? Briefly, in this way: his one idea naturally is to produce an attractive fabric that will sell. He is rather prone to think little of what troubles the gray mill will have in weaving or of the finishing plant in finishing, but those things should be carefully considered in the designing of the fabric. If the floats in the rayon stripes are too long or not properly tied down it is quite probable that when tension, even though only a small amount of tension, is put on the fabric in finishing, the rayon stripe is more than apt to break. The gray mill should endeavor to use its influence with the converter with a view to having him consider this matter carefully in the designing of his fabric, because the mill is almost as much interested as the finishing plant in producing good finished results.

Most of us are familiar with the one big problem of the mill in the weaving of goods containing rayon. That problem is the one of tension between the cotton yarns and the rayon yarns. This matter of tension has probably been responsible for more trouble in finishing than any other one thing. This is due to the fact that in finishing the cotton yarns will stretch, while the rayon yarns have practically no resiliency.

*A paper presented before the Annual Meeting of the Southern Section of the American Association of Textile Chemists and Colorists, October 10, 1925.

One of the most important things for the finisher who handles rayon striped goods to do is to give these goods the proper gray inspection before the finishing is started. This may save him a great deal of trouble later on. It is hardly possible, at least it is not practical, for a finisher to inspect every single piece of gray goods, but he can inspect a sufficient number of pieces to satisfy himself that the lot as a whole runs satisfactorily. Of course, we all realize that every loom is a separate unit, and it does not by any means follow that because some pieces from a certain mill are satisfactory all pieces are satisfactory, nor does it mean that because in some pieces the rayon is too tight that all goods from that mill are too tight. It is reasonable to suppose, however, if a sufficient number of pieces are examined and found to be all right, that the lot as a whole will be satisfactory. Simple methods for this inspection should answer the purpose. One is to look at the creases where the yarding machine blade has folded the piece, and see if a saw-tooth effect is noticeable. By that I mean that if the silk is too tight the silk threads will be drawn in on these creases, giving this so-called saw-tooth effect. Another simple and possibly better way is to run one's fingers into the fold and pull them toward the selvage. If the rayon is tight a decided cord effect will be noticed when the fingers pass over the rayon stripe. Another way is to take a small section of cloth, say 6 inches in length, cut the threads so as to remove carefully one of the rayon threads, then do the same thing with a cotton thread and see what difference, if any, develops in the lengths of the two threads. A difference of 5 per cent is usually not considered excessive. If the goods are found to contain tight rayon they should be held out of process and the customer notified. This question of tight rayon is one that should have very close co-operation between the mill and the finisher. In recently handling with a gray mill the question of certain pieces of goods in a lot containing tight rayon the mill man stated to me that he knew the goods contained tight rayon and that they had been put aside by him and invoiced to his customer as seconds. He seemed to think that by so invoicing the goods he had assumed all the responsibility to which he was justly entitled. The average person would also probably agree with him. The fact remains, however, that when seconds are invoiced to a finishing plant, the finisher assumes that there are probably weaving imperfections, oil spots or things of that kind that have necessitated the classing of the goods as seconds. In this particular case the goods were not invoiced to us as seconds; but even if they had been we would have assumed one of the defects just mentioned. If goods contain tight rayon the mere classing of these goods as seconds does not make it any easier for the finisher to prevent the breaking of the rayon. It is my opinion that such goods should not be classed as seconds, but should be classed as containing tight rayon and so invoiced to the finishing plant. If the finisher then wants to assume the responsibility after inspecting the goods, he, of course, is at liberty to do so. If he does not care to assume such responsibility, he can so notify his customer and the customer can then assume that responsibility if he feels so inclined. In any event the finisher is informed that the goods do contain tight rayon and can therefore be particularly careful in their handling.

The bleaching of goods containing rayon, as stated above, is quite similar to the bleaching of all cotton goods. There are two main considerations for the finisher to keep constantly in mind in the finishing of rayon striped goods: First of all, he should no nothing that will have a tendency to break the rayon. When rayon is broken by the finisher it is usually done in the bleaching process and therefore while the goods are in the rope form. You are doubtless familiar with the fact that rayon, when wet, has practically no tensile strength, and therefore care in handling, while the goods are wet, cannot be too strongly emphasized. The other big problem for the finisher is to put nothing in the goods when starching or finishing that will affect the luster of the rayon. The rayon stripe is put in because of its luster to beautify the fabric, and if, therefore, anything is done to the goods to deaden the luster of the rayon, the finisher has fallen down in producing one of the main results desired in finishing the goods. If, therefore, these two main points are kept constantly in mind during the bleaching and finishing processes, very little trouble need be expected.

The goods are first sewed together into continuous lengths, and sometimes put over a singer for a light singeing. If it can be avoided it is better not to singe the goods, because it is very easy to damage rayon stripes by having them come in contact with a hot flame. After singeing, the goods should be treated with diastafor for the purpose of removing the starch. If the goods contain no color—that is, either colored cotton threads or colored silk threads—they can be run into a kier for a regular boil. Some plants prefer not to boil even all-white fabrics, but a great many plants do give them a regular pressure boil, after which they are pulled out of the kier, washed, given a chlorine treatment and allowed to stand long enough for the bleaching to be completed; then again washed, given an anti-chlor treatment, washed again and piled in the white bins ready for finishing. It is during these various washings, while being bleached, that extreme care must be taken to minimize the amount of tension put on the goods. It is preferable to use a slack washer; but as all plants are not equipped with slack washers, those that are not get very good results without them if proper care is taken to minimize the tension. After bleaching, the goods are pulled out and opened up on a scutcher, and usually lightly mangled. A heavy mangling is very dangerous, because at this point the goods are still wet and therefore in a condition to make extremely easy the breaking of the

rayon threads. On some goods it is desirable not to mangle them at all, especially where the rayon passes over cords; and on still others it is sometimes found more desirable not even to put them over a scutcher but to open them up by hand, which is naturally an extremely slow process but, even at that, better than damaging the cloth.

Goods containing colored cotton threads or colored silk threads must be bleached in a slightly different way from all-white goods. They cannot be boiled as goods are that contain no color. Of course, if a peroxide bleach is employed, the entire bleaching process, whether the goods contain color or not, is conducted in the kier; but my remarks are concerned chiefly with the chlorine bleach. Goods containing color are usually scoured in an open soaper in lieu of boiling, and then bleached as outlined above for all-white fabrics. It is sometimes necessary to treat more than once with chlorine goods containing colored yarn, this being made necessary because they have not been boiled and therefore have not had well removed the motes and other foreign substances. It is sometimes found necessary, on goods containing blue stripes, to develop them with hydrosulphite after bleaching in order to restore their original color. I have noticed a difference in the amount of luster developing in goods containing colored silk yarns. A gold shade is always very brilliant, helio shade less brilliant, and a blue shade having less luster than any. This is doubtless due to the fact that the gold color, next to the white, reflects the light better than the other colors, and the blue reflects it worse.

From this point the problem becomes one of finishing; so after the mangling mentioned above, the goods are dried and are then ready either for dyeing or for finishing. There is nothing special to be said about the dyeing of these fabrics, because they are practically always dyed into light or medium shades which can be produced on a padder in the same manner as all cotton fabrics. In the finishing of them, however—in fact, of any fabric containing rayon—the second big feature for the finisher to remember—namely, that of preserving the luster of the silk—should be especially kept in mind. Large quantities of starch and oil should not be used. It is desirable in starching to use starching materials with transparent qualities, such as gums and waxes of various kinds. Starches have a tendency to coat over the silk stripe and to prevent the reflection of light, while gums and waxes, having transparent qualities, do not to any appreciable extent affect the luster of the silk. Fabrics of this kind are usually finished into soft or semi-soft finishes, so that large quantities of starch are not necessary. After starching, the goods are dried, or partially dried, and stretched to the desired width on the tenter frame, at which time the drying can be completed. The calendering or finishing and the put-up and packing are then done, depending upon the particular requirements of the customer.

A paper of this kind would not be complete without briefly mentioning the possibilities of Celanese. Some wonderful cross-dyeing effects have been secured with this new form of silk, and in this age of violent style fluctuations and the demand for anything new or novel there seem to be wonderful possibilities in this field. There has been very little development in the South in the bleaching, dyeing and finishing of fabrics containing Celanese. There is no reason why it cannot be satisfactorily done, and the time should not be far distant when there should be more goods of this type manufactured in the South, goods bleached, dyed and finished in the South. More and more of the cotton mills are experimenting with its manufacture, and if it enjoys the popularity that I believe is ahead of it, it will not be long before Southern finishing plants will be well fixed to handle it.

There are a few important things to keep in mind in the bleaching of goods containing Celanese, one being that it will not stand high temperatures and therefore cannot be boiled in a kier. The temperature should not exceed 180 degrees in the bleaching, dyeing or finishing if the lustre of the silk is to be preserved. Also, the chlorine bath which can be used in bleaching it should be kept as nearly neutral as possible. The dyeing is handled in very much the same mechanical manner as the dyeing of all-cotton or other artificial silk striped fabrics. Special dyes must be used, such dyes being made by the manufacturers of Celanese as well as by other dyestuff manufacturers. Cotton has no affinity for these dyes and the Celanese has practically no affinity for regular types of cotton dyes. Therefore, the two types of dyes can be made up in the same bath and on passing the goods through this mixture the desired results can be obtained on both silk and cotton.

There are many forms of both manufacturing and finishing now being done in the South, including the production of large quantities of fabrics containing rayon, which for one reason or another it was thought for a long time could not be succesfully handled in the South; this feeling has now long since disappeared. We who are gathered here are all interested in the same or similar lines. The spirit of co-operation and mutual helpfulness which Southern mills have shown toward each other for a great many years has been largely responsible for the position the South now holds in the textile field, and only by a continuance of that policy and by meetings of this kind, where we all come together for the purpose of learning something new or of improving our present methods, can we hope to make in the South the progress that we should.

THIRTY-THIRD COUNCIL MEETING

The thirty-third meeting of the Council of the American Association of Textile Chemists and Colorists was held at the Engineers Club, Boston, Mass., on Friday, September 25, 1925.

The following members were in attendance: L. A. Olney, E. H. Killheffer, A. E. Hirst, W. C. Durfee, W. M. Scott, W. K. Robbins, G. A. Moran, J. F. Bannan and W. E. Hadley, together with the following members of the Research Committee: H. Christison, W. H. Cady, W. D. Appel, W. J. Murray and A. A. Claflin.

Letters of regret at being unable to attend this meeting were received from W. D. Livermore, R. F. Culver and P. J. Wood.

The following applicants were elected to membership:

Active Members

Boyd, Louis M., dyer, Elliott Knitting Mills, Hickory, N. C.

Brandt, Carl D., assistant superintendent and chemist, Lowell Bleachery, South, Experiment, Ga.

Guernsey, F. H., chief chemist, Cowles Detergent Company, Lockport, N. Y.

Logan, Geo. H., superintendent, Swiss Hosiery Mills, 3823 W. Chestnut Street, Louisville, Ky.

Mueller, Curt, assistant superintendent, dyeing and bleaching, Bibb Manufacturing Company, 119 Nottingham Drive, Macon, Ga.

Ruger, George O., textile colorist, Ruger Textile Corporation, 49-51 Fulton Street, Brooklyn, N. Y.

Supple, William H., dyer, 50 Fishkill Avenue, Beacon, N. Y.

Winkler, Alfred, chief chemist, Somerset Aniline Works, Pluckemin, N. J. Box 124, Far Hills, N. J.

Junior

Marsh, Robert F., chemist, Amoskeag Manufacturing Company, 376 Manchester Street, Manchester, N. H.

Pennock, William W., colorist, Amoskeag Manufacturing Company, Manchester, N. H.

The following were elected to Corporate Membership: E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. W. F. Harrington, general manager of Dyestuff Department. Cesare Protto was designated to act as representative in the affairs of the Association.

New York Color & Chemical Company, Main and Joralemon Streets, Belleville, N. J. P. R. Mackinney, president and treasurer; John W. Richmond, assistant treasurer, and John G. Wardlaw, secretary. J. R. Mackinney was designated to act as representative in the affairs of the Association.

The meeting was given over largely to a consideration of the coming Annual Meeting which is to be held in Boston, Mass., on December 4 and 5, 1925.

J. F. Bannan, Chairman of the Northern New England Section of the Association, will be in charge of the arrangements for the Annual Meeting, and Wm. H. Cady and Prof. L. A. Olney were chosen to act with him. The committee can be enlarged as required.

J. B. Dick was transferred from Junior to Active membership.

A request was received from the Southern Section asking permission to subdivide the Section owing to the area covered. E. H. Killheffer was appointed Council representative to confer with the leaders of the Southern Section, at their Local Meeting, with power to act, if twenty-five members of the Section requested such division in writing.

Respectfully submitted,

W. E. Hadley, Secretary.

OCTOBER MEETING OF THE NORTHERN NEW ENGLAND SECTION

The first seasonal meeting of the Northern New England Section of the American Association of Textile Chemists and Colorists was held at the Lowell Textile School on October 17, 1925.

President Charles H. Eames of the Textile School was a guest of the Section at this meeting. He extended many favors to the Section on behalf of the School which contributed much to the general success of the meeting. The sincere thanks of the Northern New England Section is herewith extended to Mr. Eames and to the School for the many courtesies shown.

The excellent dinner served at the School was attended by twenty-nine members and guests. Those who came later brought the total attendance at the meeting to fifty. Immediately following dinner a lecture on glass blowing, spinning and decorating was presented. The demonstrations in glass-working which went along simultaneously with the lecture were highly instructive. Many objects of a decorative nature were made by a skilled glass worker.

The Section has the honor and privilege of entertaining the other Sections of the Association at the Annual Meeting to be held in Boston, December 4th and 5th. Committees have plans worked out and it is fully expected that the usual great success and pleasure of this event will be assured.

A. K. Johnson, Secretary.

Applicants for Membership

Active

Dabbs, John L., sales manager, E. I. du Pont de Nemours & Co., Charlotte, N. C. Sponsors: J. E. Moore and Chas. H. Stone.

Davis, Armand C., chemical engineer, Slater Mills, Webster, Mass. Sponsors: R. W. Hook and W. J. Murray.

Fidelgoltz, L. L., application chemist, John Campbell & Co., New York City, N. Y. Sponsors: Geo. C. Lommel and D. L. Clarenbach.

Furman, Albert, foreman dyer, Boyd & Co., Inc., Bronx, N. Y. Sponsors: C. C. Knights and H. M. Herrmann.

Grimshaw, A. H., associate professor, North Carolina State College, Raleigh, N. C. Sponsors: E. H. Hinckley and W. R. Carthcart.

Hood, Geo. C., dyer, Merrimack Manufacturing Company, Lowell, Mass. Sponsors: L. A. Olney and R. B. Clogston.

McNab, John H., dyestuff salesman and demonstrator, Nyanza Color & Chemical Company, Knoxxville, Tenn. Sponsors: W. S. McNab and H. W. Ormand.

Millen, John M., mercerizer, National Yarn & Processing Company, Chattanooga, Tenn. Sponsors: P. F. O'Neill and H. L. Seiver.

Phettephael, B. S., general manager, Southern Franklin Process Company, Greenville, S. C. Sponsors: J. E. Moore and Chas. H. Stone.

Junior

Stringfellow, W. A., textile chemist, National Aniline & Chemical Company. Sponsors: Chas. S. Hollander and F. R. McGowan.

Resignations

Alexander, Sherman Y., Dorchester, Mass.

Fernandez, R. O., Melrose, Mass.

Low, Giles, Passaic, N. J.

Prevost, F. H., Anderson, S. C.

Changes of Address

Betz, L. Drew, care of W. H. & L. D. Betz, E. Ontario and Bath Streets, Philadelphia, Pa.

Bloxham, Harold C., 311 West Avenue, Pawtucket, R. I.

Callahan, Charles A., 576 Gage Avenue, New South Memphis, Tenn.

Callahan, Chas. A., care of American Finishing Company, New South Memphis, Tenn.

Chase, Harold D., 112 Gregory Avenue, Passaic, N. J.

Duhring, Edwin L., care of Dunham-Watson Company, 638-44 South Clark Street, Chicago, Ill.

Gainey, Frank W., 131 Parls Street, South Manchester, Conn.

Gardner, J. E., 741 Broad Street, Bloomfield, N. J.

Jones, R. L., 103 Beechwood Avenue, Bound Brook, N. J.

Mackenzie, Malcolm, Pox 81, Charlotte, N. C.

Mungall, Thomas G., P. O. Box 1572, New Orleans, La.

Sturtevant, F. N., 60 Grove Street, Lowell, Mass.

Tessier, Victor F., 19 Main Street, Slatersville, R. I.

Wang, Chen, 109 Ithaca Road, Ithaca, N. Y.

Watson, John C., 156 Olive Street, Attleboro, Mass.

Wooffindale, W. H., care of John Boyd Company, Williamstown, Mass.

The Fifth Annual Meeting

of the

American Association of Textile Chemists and Colorists

will be held in Boston, with sessions *Friday evening, December 4th,* and all day *Saturday, December 5th.*

The Council is considering holding an **Open Forum,** Friday evening, where opportunity will be given to discuss subjects of interest to members.

If you have in mind any subjects which you should care to have discussed at this time, or if you are willing to open or take part in the discussion of any subject, kindly advise either the President or the Secretary immediately, so that it may be printed on the program, which will be issued early in November.

REDUCED DEMAND FOR FOREIGN SILKS

Silk manufactures imported into the United States show a big fall-off in recent years. The value of silk manufactures imported in the fiscal year ending with June, 1925, only aggregated 37 million dollars against 41 millions in 1924, 55 millions in 1921 and 88 millions in 1920, the 1925 figures being less than the annual average during the last ten years.

This fall-off in the value of silk manufactures imported, says the Trade Record of the National City Bank of New York, is more remarkable when we consider that the silks imported in 1925 were made from a raw material which has doubled in price in recent years; yet, it is a fact that the total value of the silk manufactures imported in 1925 was less than one-half that of 1920. How did it happen that the United States has reduced its demand upon the foreign world for silk manufactures just at a time when the demand for the luxuries of life shows such a remarkable increase?

The explanation apparently lies in the increasing quantities of silk manufactures turned out by our own factories, and at the same time, the increased use of the new fibre "rayon" from which manufactures similar to those of silk are now produced. The increase in the outturn of our own silk factories is evidenced by the recent census of manufactures which shows the value of the output of the silk factories of the United States in 1923 at 761 million dollars against 254 millions in 1914, a decade earlier, while the increase in the use of the new substitute for silk is evidenced by the fact that our output of artificial silk or "rayon" has grown from 2½ million pounds in 1913 to 35 million pounds in 1923, and the consumption by our factories has advanced from 4 million pounds in 1913 to 40 millions in 1923.

This fall in the importation of silk manufactures is in marked contrast with the importation of raw silks, for which we are entirely dependent on other countries. The value of raw silk imported in the fiscal year 1925 was 353 millions dollars against 100 millions in 1914, and it was used in our own factories chiefly for the manufacture of silk goods for our own people. Incidentally, however, we have increased our exportation of silk manufactures from 2½ million dollars in 1914 to 17 millions in 1925, of which "broad silks" amount to about 3 million dollars value, and silk hosiery, 9 millions, and these big exports of silk manufactures go in considerable quantities to the great silk producing countries of the world. Our 1924 exports to China, one of the great silk producing countries, included silk laces, hosiery, ribbons, velvets, plushes, broad silks and chenilles; to Japan another great producing and manufacturing country, considerable quantities of velvets, plushes and chenilles; also other silk manufactures, especially hosiery and underwear made in part from artificial silk. The United States consumes practically one-half of the world's output of raw and artificial silk and produces more silk manufactures than any other country. Our exports of silk manufactures in 1925 is 7 times as much in value as in 1913.

NORTHERN CHINA DYESTUFFS MARKET

Importations of indigo into Tientsin for the first six months of 1925 were 20,203 piculs, against 27,506 piculs for the corresponding period of 1924. The 1925 importations seem to be normal as 1924 figures were higher than consumption warranted, due to a desire on the part of German importers to bring up their stocks depleted in 1923.

Spring indigo business was fair, but did not reach the high figures expected as a result of the cessation of business in the last half of 1924. This failure of the market to come up to expectations was due to lack of transportation facilities which prevented an easy flow of undyed and dyed cloth to and from the dyeing centers.

Sulphur Black statistics are not yet available, but the business continued to increase in volume, with Japanese and American firms doing most of the business, due to the high prices quoted by the German companies during the first quarter of the year. This situation was changed by a 20 per cent cut in prices by the German sellers at the end of a period under review, so that the fall season will probably see extremely severe competition in this color, with lower prices than prevailed in the spring.

Imports of other colors for the first six months of 1925 were valued at 226,486 haikwan taels againts 1,114,138 haikwan taels for the corresponding period of 1924. This falling off of imports was due chiefly to the very heavy stocks carried over from 1924, sales being about normal, although these were also hindered by the poor transportation facilities.

At the beginning of July, indigo prices were fluctuating around 28 to 33 taels per picul. These prices are the lowest that have prevailed in China for many years.

LACTAMINE

A new mordant for which S. R. David & Co., Inc., are distributors in New England, is known as Lactamine, and is described in a recent circular issued by this concern. It is said to be of importance for the mordanting of wool with bichromates, exerting a great reducing power toward chrome. In dyeing silk effects 2 or 3 per cent of Lactamine is added to the second bath with the acetic and chrome, producing a bloomier color and a white silk. In dyeing shoddy the combination of Lactamine and chrome acts as a stripper.

Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturing Association, recently delivered a lecture to the students in the Textile School of the North Carolina State College, Raleigh, N. C., taking as his subject, "The Dyeing Industry in America."

The Reduction Products of Azo Dyes

Part III

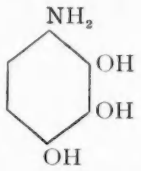
By WALTER C. HOLMES

Color Laboratory, Bureau of Chemistry

[EDITOR'S NOTE.—*The most practical and effective method for the identification of azo dyes consists in the isolation and identification of the products which they yield on reduction. This method finds less application than it might or should, partly because some of these products have never been isolated and investigated, and partly because much of the data which has been obtained in regard to such reduction products is greatly scattered and very difficult to locate.*

Mr. Holmes has made a search for all the available information on such reduction products, and this series contains a digest of his results with a systematic listing of the reduction products of the azo dyes published in the Colour Index, together with the available data on such properties and reactions as would be of service in their identification.]

No. 17.—4-AMINOPYROGALLOL



$C_6H_7NO_3$; Mol. Wt. 141.09; (C, 51.1%; H, 5.0%; N, 9.9%; O, 34.0%).

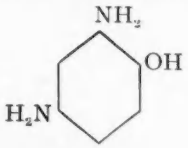
Derived from: C. I. Nos. 58 and 171.

Free base is unstable, being readily oxidized.

Hydrochloride, Brownish needles or nearly colorless fine needles (alc. — Ac HO). Readily sol. in H_2O, difficultly sol. in ethyl acetate. Sols. of hydrochloride are readily oxidized in air, aqueous sols. turning dark violet and alcoholic sols. brown. On adding alkali and shaking obtain an intense blue color, becoming more violet on standing, with ammonia a blue color turning dark red (Barth) $FeCl_3$ gives an intense blue color, soon turning brown.

Heated with benzoyl chloride it gives dibenzoyldioxyphenylbenzoxazol, white needles (benzene-gasoline), mpt. 144°. Aqueous sols. of this are unaffected by alkalies or $FeCl_3$.

No. 18.—2, 4-DIAMINOPHENOL



$C_6H_8N_2O$; Mol. Wt. 124.11; (C, 58.0%; H, 6.5%; N, 22.6%; O, 12.9%).

Derived from: C. I. Nos. 98 and 99 by complete reduction.

Free base, white leaflets, mpt. 78-80° (decomp.). Very unstable, turning brownish black in air quickly. Aqueous sols. of the base are colored intense blue by NaOH.

Aqueous sols. of the salts cryst. well but soon turn brown. With $FeCl_3$ + bichromate they give aminoquinonimide-bichromate, green-black glittering grains, sol. in cold H_2O with red color; with $FeCl_3$ + picric acid the corresponding picrate, chocolate-brown cryst., sol. in H_2O with a blood-red color.

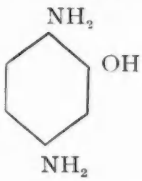
Hydrochloride, needles. *Sulfate* (+ $2H_2O$), rhomb. plates.

Oxalate, sol. in 2,000 parts cold, 33 parts hot water.

Picrate, citron-yellow needles, mpt. about 120° (decomp.), sol. in 33 parts H_2O at 15°.

Diacetyl deriv., needles (H_2O), mpt. 220-2°, sol. in alc., Ac HO and boiling H_2O; *triacetyl deriv.,* mpt. 180-2°, gives the diacetyl deriv. with cold dil. NaOH; *dibenzoyl deriv.,* reddish leaflets (alc.), mpt. 185-188° (Stuckenberg, Ann. *205,* 71), small gray scales (alc.), mpt. 253-4° (Meldola and Hollely, J. Chem. Soc., *101,* 931); *tribenzoyl derivs.,* $C_6H_3OH.(N[COC_6H_5]_2).(NHCOC_6H_5)$ rhomb plates, mpt. 231-3°, insol. in H_2O and alc. sl. sol. in Ac HO, readily sol. in warm alc.; $C_6H_2.(OCOC_6H_5):(NHCOC_6H_5)_2$, white microcryst. (Ac HO) mpt. 240-2°.

No. 19.—2, 5-DIAMINOPHENOL



$C_6H_8N_2O$; Mol. Wt. 124.11; (C, 58.0%; H, 6.5%; N, 22.6%; O, 12.9%).

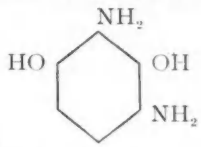
Derived from: C. I. No. 106.

Hydrochloride, long colorless needles, readily sol. in H_2O, sl. sol. in HCl. The aqueous sol. soon becomes colored violet in the air.

Diacetyl deriv., glittering needles, readily turning brown, mpt. 265°. Nearly insol. in cold H_2O, somewhat sol. in boiling H_2O, readily sol. in alc., Ac HO or cold dil. alkalies.

Triacetyl deriv., colorless lustrous leaflets (H_2O), mpt. 234°. Nearly insol. in cold H_2O, readily sol. in alc., Ac HO or hot H_2O. Dissolves slowly in dil. NaOH with the loss of one acetyl group.

No. 20.—2, 4-DIAMINORESORCIN



$C_6H_8N_2O_2$; Mol. Wt. 140.11; (C, 51.4%; H, 5.8%; N, 20.0%; O, 22.8%).

Derived from: C. I. Nos. 1, 234-236, 598, 601, 602, 610 and 611.

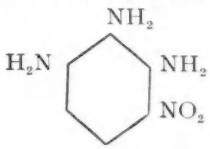
The free base turns brown in the air quickly. It gives a violet color with NH_3 and a (violet) blue color with $FeCl_3$ soon turning dirty brown. With aniline, alc. and Ac HO in the cold it gives a green color.

Hydrochloride, also relatively unstable. Suspended in $CHCl_3$ with a few drops of NaOH sol. and shaken with H_2O the latter becomes colored cornflower-blue.

Sulfate ($+1\frac{1}{2}H_2O$), much more stable. May be pptted. from aqueous sol. in cryst. form by the addition of excess H_2SO_4 or (better) by that of alc.

(The salts give the same reaction with $FeCl_3$ as the base.)

No. 21.—4-NITRO-1, 2, 3-TRIAMINOBENZENE

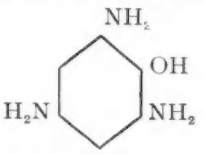


$C_6H_8N_4O_2$; Mol. Wt. 168.13; (C, 42.8%; H, 4.8%; N, 33.3%; O, 19,0%).

Derived from: C. I. Nos. 221, 334, 368, 369 and 440 by incomplete reduction.

Apparently no data is available respecting this product.

No. 22.—2, 4, 6-TRIAMINOPHENOL



$C_6H_9N_3O$; Mol. Wt. 139.13; (C, 51.8%; H, 6.5%; N, 30.2%; O, 11.5%).

Derived from: C. I. Nos. 7, 101-108, 245 and 272.

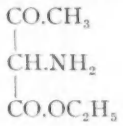
The free base is very unstable. Sols. of the salts oxidize very easily, reduce ammon. silver sols., turn brown with alkalies and are colored intense blue by $FeCl_3$ (formation of aminodiiminophenol).

Hydrochloride, pptted. from sol. by HCl, forms double salt $[C_6H_2(NH_2)_3OH.3HCl.SnCl_2]$ with $SnCl_2$, leaflets, cryst. from aq. sol. with $1\frac{1}{2}H_2O$. On long exposure over H_2SO_4 the latter loses 1 mol. HCl, turning orange-red.

Sulfite, sl. sol. leaflets, mpt. 120-1°; *picrate*, citron-yellow needles, mpt. 96-7°, dissolves in 500 parts of H_2O at 15°.

Triacetyl deriv., micr. plates, mpt. 279°, sl. sol. in hot C_6H_6, $CHCl_3$ and ether; *tetraacetyl deriv.*, micr. prisms (H_2O), mpt. 255° (decomp.), more sol. in H_2O and alc. than the triacetyl deriv. and gives the latter deriv. with dilute alkalies; *hexaacetyl deriv.*, prisms (alc.), mpt. 184°, readily sol. in H_2O and alc. (difficultly sol. in C_6H_6), gives the triacetyl deriv. with dilute alkalies.

No. 23.—AMINO ACETOACETIC ETHER



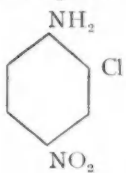
$C_6H_{11}NO_3$; Mol. Wt. 145.13; (C, 49.6%; H, 7.6%; N, 9.7%; O, 33.1%).

The free base soon changes in air to a colored subst. of the type of purpuric acid which decomp. above 250° without melting.

Hydrochloride, needles (ether-alc.), mpt. 95° (with turbulent decomp.), hygroscopic and very sol. in H_2O and alc., insol. in ether. Very reactive, reducing Fehling's sol. in cold. With alkalies get *dimethylpyrazinedicarboxylic acid*, mpt. 86°; with phenylhydrazine get phenylmethylpyrazon-azobenzene, orange-red needles, mpt. 155°.

Picrate, fine needles, mpt. 129° (turning brown).

No. 24.—o-CHLOR-p-NITRANILINE



$C_6H_5ClN_2O_2$; Mol. Wt. 172.55; (C, 41.7%; H, 2.9%; Cl, 20.5%; N, 16.2%; O, 18.5%).

Derived from: C. I. Nos. 586 and 587 by partial reduction.

Clear yellow needles, mpt. 104.5°.

The acid salts are unstable.

Acetyl deriv., light straw-yellow flat needles or prisms (alc.), mpt. 139°. Gives *2-chlor-4-aminoacetanilide* on reduction, pale yellow plates (H_2O), mpt. 111°, and *2-chlor-4-nitrosoacetanilide* on subsequent oxidation with Caro's acid, green needles, mpt. 112-3°, sl. sol. in hot H_2O.

Diacetyl deriv., white needles, mpt. 197°; *benzoyl deriv.*, pale yellow needles (alc.), mpt. 161° (giving *chlor-p-phenylene diamine* on reduction, white needles (benzene-ligroin), mpt. 63-4°); *dibenzoyl deriv.*, white needles ($CHCl_3$), mpt. 228°.

Condens. prod. with formaldehyde, pale yellow needles (Ac HO), mpt. 282°.

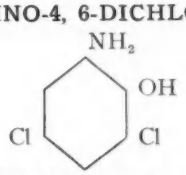
On alk. oxidation with hypochlorite gives *2, 2'-dichlor-4, 4'-dinitroazobenzene*, brownish-red prisms (solv. naphtha), mpt. 274°, the hydrazo deriv. of which cryst. from alc.-acetone in pale yellow prismatic needles, mpt. 214-5°.

Gives m-chlornitrobenzene with nitrous ether.

Gives Cl-p-phenylenediamine on reduction.

Diazotized and coupled with: *β-naphthol*, glistening red needles (Ac HO), mpt. 282°, red-purple sol. in H_2SO_4, orange-red pptte. on dil.; *Naphthol AS*, small orange-red needles (Ac HO), mpt. 313°, purple sol. in H_2SO_4, red pptte. on dil.

No. 25.—2-AMINO-4, 6-DICHLOR PHENOL



$C_6H_5Cl_2NO$; Mol. Wt. 178.0; (C, 40.5%; H, 2.8%; Cl, 39.8%; N, 7.9%; O, 9.0%).

(*Continued on page* 740)

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

ALIZARINE V

(Schultz No. 788)

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant and also top chrome, using only acetic acid.

SHADE: Maroon on chrome mordant; bright red on alumina mordant.

FASTNESS TO:
Alkali: Turns bluish with ammonia.
Fulling: Good.
Light: Fast.

DYED BY OTHER METHODS: May be used as a bottom for Indigo. Gives Indigo test.

ON OTHER MATERIALS: Silk: With alumina mordant.

PRINTING: On wool with alumina or chrome.

COMPETING PRODUCTS: Made in the United States by Beaver Chemical Works, under name of Alizarine BC; National Aniline & Chemical Company, under name of Alizarine NAC.

ALIZARINE ORANGE

(Schultz No. 779)

COMPOSITION: Powder is the sodium salt of the paste.

SPECIALLY SUITABLE FOR: Loose wool yarn and pieces.

USUAL METHOD OF DYEING: Chrome mordant and also top chrome; use only acetic.

SOLUBILITY: Good.

LEVEL: Top chrome, fair; pieces require care.

FASTNESS TO:
Carbonizing: Fast.
Chlorine: Fair; shade turns lighter.
Light: Inferior to Alizarine Red W on a chrome mordant.

OTHER PROPERTIES: Dyed top chrome, stands Government tests well.

DYED BY OTHER METHODS: May be dyed by oxalic acid fluoride of chrome method and used to shade the Anthracene Blues. Dyes chromate fairly well

ON OTHER MATERIALS: Silk: With both chrome and aluminum mordants.

PRINTING: On wool: Suitable with chrome.

COMPETING PRODUCTS: Made in the United States by Beaver Chemical Works, under name of Alizarine Orange; National Aniline & Chemical Company, under name of Alizarine Orange RP.

ALIZARINE RED W

(Schultz No. 780)

COMPOSITION: Sodium salt of alizarine sulphonic acid.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant. Top chrome (light shades use acetic acid; dark shades use oxalic).

SHADE: Claret red with chrome; bright red with alumina.

SHADE BY GASLIGHT: Turns yellower.

SOLUBILITY: Excellent.

LEVEL: Top chrome very good; best of the Alizarine Reds.

EXHAUSTS: Not completely.

FASTNESS TO:
Acid: Top chrome shows a good fastness to acids.
Alkali: Turns bluish with ammonia.
Carbonizing: Moderate.
Fulling: On a chrome mordant: good against white wool, poor against cotton.
Ironing: Fast.
Light: Very good; suitable for men's wear.
Perspiration: Fast.
Potting: Very poor dyed acid.
Rubbing: Fast.
Steaming: Fast.
Sulphur: Very poor dyed acid.
Washing: Good on a chrome mordant.
Stripping: Extremely difficult to strip.

OTHER PROPERTIES: Alizarine Red PS (S-783) is faster to fulling than Alizarine Red W.

DYED BY OTHER METHODS: By adding sulphate of zinc to the bath when dyeing, a bright red with a very bluish cast is obtained. May be dyed by oxalic-fluoride of chrome method. Chromate: Dyes fairly well, but does not exhaust and is rather weak.

ON UNIONS: Cotton and silk effect threads are stained pink.

ON OTHER MATERIALS: Wool-silk: Dyed on a mordant, leaves the silk practically white. Silk: On a chrome mordant (alumina mordant not suitable). Chrome tanned leather: Good.

PRINTING: Adapted for vigoureux printing with acetate of chrome or alumina. The fastness to fulling and potting is only fair.

COMPETING PRODUCTS: Made in the United States by Beaver Chemical Works, under name of Alizarine Red S.; E. I. du Pont de Nemours & Co., under name of Alizarine Red S Powder.

ANTHRACENE BROWN
(Schultz No. 782)

COMPOSITION: Powder is the sodium salt.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant. Neutral or with very little acid.

SHADE: Dark brown reddish shade.

SHADE BY GASLIGHT: Redder.

LEVEL: Dyes level in dark shades.

FASTNESS TO:
Acid: Fair.
Alkali: Fair.
Fulling: Excellent; stands heavy fulling.
Ironing: Fast.
Light: Suitable for men's wear.
Perspiration: Fast.
Steaming: Fast.
Washing: Fast.
Water: Fast.

SENSITIVE TO METALS, LIME: Sensitive to iron.

OTHER PROPERTIES: In combination with Fast Mordant Yellow (S-294) a range of browns varying from a yellow tone to a red tone can be obtained.

DYED BY OTHER METHODS: Chrome unsuitable; very weak.

ON OTHER MATERIALS: Silk: Alum mordant gives varying results. Chloride of chrome mordant, good.

PRINTING: Cotton: Acetate of chrome, also alumina and iron. Stands boiling with 1 per cent Rongalite without changing shade.

COMPETING PRODUCTS: Made in the United States by Consolidated Color & Chemical Company (Selling Agents, General Dyestuffs Corporation), under names of Alizarine Brown CC and Alizarine Brown RC; Zinsser & Co., under names of Alizarine Brown O and Alizarine Brown OR; National Aniline & Chemical Company, under name of Alizarine Brown R; E. I. du Pont de Nemours & Co., under name of Anthracene Brown Powder; Palatine Aniline & Chemical Works (Selling Agents, F. E. Atteaux & Co.), under name of Empire Alizarine Brown R.

INDANTHRENE OLIVE G
(Schultz No. 791)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Caustic and hydrosulphite at 140 deg. Cent.

SHADE: Dull yellowish olive.

SHADE BY GASLIGHT: Unchanged.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Very good.
Alkali: Last.
Carbonizing: Fast.
Chlorine: Destroyed.
Cross-Dyeing: Fast.
Fulling: Fast.
Ironing: Fast.
Light: Not very good.
Perspiration: Fast.
Rubbing: Fast.
Washing: Fast.

DYED BY OTHER METHODS: Suitable for cop dyeing. Suitable for dipping vat. Paste form is suitable for pad dyeing; powder is not.

ON OTHER MATERIALS: Good for wall paper paste colors. Mix with barytes alumina and soda. Use only the paste brands. The fastness to light is very good. It is insoluble in water and resists action of lime and alkalies.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under names of Amanil Vat Olive and Amanthrene Olive .G.

ANTHRACENE BLUE WRR
(Schultz No. 789)

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant; boil at least two and one-half hours.

SRADE: Navy blue.

SHADE BY GASLIGHT: Redder.

LEVEL: Dyes level on pieces.

EXHAUSTS: Not clear.

FASTNESS TO:
Acid: Redder; not as good as Alizarine Blue (S-803).
Fulling: Fairly fast.
Ironing: Fast.
Light: Fast; suitable for men's wear.
Perspiration: Redder.
Rubbing: Fast if dyed properly.
Sulphur: Fast.
Washing: Scours off slightly.

OTHER PROPERTIES: Largely used in the dyeing of men's wear serges.

ON OTHER MATERIALS: Silk: Chloride of chrome mordant; fast to washing and fulling. Cotton: Chloride of chrome mordant; fast to washing and fulling.

(Continued on page 743)

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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MISLEADING CLAIMS FOR IMPORTED DYESTUFFS IN ADVERTISEMENTS OF FAST-COLOR FABRICS

AT very regular intervals some years ago and less frequently since then The REPORTER has had occasion to call attention to the statements made by manufacturers or retailers selling guaranteed fast-color fabrics to the effect that goods so guaranteed are dyed with imported colors.

During the early days of the American dyestuff industry there was no doubt ample occasion to claim superior fastness for goods dyed with German or Swiss colors. To-day, as everyone who has kept abreast of the American dyestuff industry well knows, there is no such occasion. In other words, anthraquinone vat dyestuffs—whether sold under "Indanthrene," "Anthrene," "Ponsol" or other labels—are, type for type, identical and consequently of equal fastness. Hence, a retailer or manufacturer who advertises his goods as dyed with *imported* vat colors adds not one whit to the credit of his product in the eyes of those who are technically well informed. The lay public, in a great majority of cases, however, still persists in attaching some significance to the magic word "imported"—and this is not alone true of dyestuffs but applies with more or less equal force to gloves, dresses and various other articles of wearing apparel.

An advertisement published in Dry Goods Economist of October 17th by E. L. Mansure Company, of Chicago, attempts to trade upon this public ignorance. In part the advertisement reads:

> These two trade expressions, "commercially sunfast" and "guaranteed sunfast" represent a tremendous difference in the permanence of color. The *imported* Indanthrene dyes (the italics are ours) used by the E. L. Mansure Company, have been proved fast by all tests. In fact, the color is so fast that, when once fixed, it cannot be removed from the fiber by any known means. Naturally, there can be no comparison between these absolutely fast colors produced by Indanthrene dyes and the so-called "commercially fast" colors produced by doubtful dyes which may still be in the experimental stage of manufacture.

While this advertisement does not specifically so state, the natual inference is that dyes still in "the experimental stage of manufacture" are American dyes.

Inquiry at the office of the E. L. Mansure Company elicits the information that they do not do their own dyeing. They weave, but their goods are dyed and finished by various outside concerns. Consequently they cannot be sure that "imported Indanthrene dyes" are used on all of their fabrics. In fact, the chances are ten to one that a large proportion of the colors used in their fabrics are actually of American manufacture. All that they can positively guarantee is that the colors are fast, which, after all, is the only thing which concerns either the retailer or the public.

This advertisement is typical of many which have appeared in the trade and general press, although we are glad to say the practice is far less prevalent to-day than it was some years ago, and this despite the fact that there is a great deal more publicity for guaranteed fast colors than at any time heretofore.

The REPORTER is at a loss to recommend adequate measures for restraining such advertising, but we do feel emphatically that everyone who has the good of the American dyestuff manufacturing industry at heart should lose no opportunity to correct every erroneous statement or impression which he encounters to the effect that foreign-made dyestuffs are superior in fastness properties to those of American make.

The public as a whole is a lethargic and unthinking mass. It is accustomed to believe what it sees in print or what it is told without making any pronounced effort to determine the truth of these assertions through individual investigation. Hence, the more often it is told that, type for type, American dyes are the equal of any of foreign manufacture, the sooner will this erroneous impression be dispelled.

Certainly any textile manufacturer or merchant who attempts to gain popularity for his goods by claiming the colors to be fast because of their having been dyed with imported dyestuffs is not only trading on the ignorance of his audience, but is grossly slandering the American dyestuff industry as well—a key industry vitally essential to the independence of American textile manufacturers and of untold importance to countless other American institutions.

FAST FABRIC STANDARDIZATION IN SIGHT

AT last discussions of fastness standards for fabrics have been crystallized into a definite plan of action. One group of textile men has now set out to establish standards to designate fastness; another is preparing to launch those standards into the world with all the publicity they deserve.

There was recently held an important meeting attended by representatives of prominent cotton trade associations and by representatives of the Federal Trade Commission, of the Laundryowners' National Association and of the Associated Advertising Clubs of the World. A committee was formed to devise standards of fastness. These will be submitted to the proper Government department for official sanction. Advertising men came forward to offer their services in the drive to make the standards common knowledge. Responsibility for observance of these fastness standards was willingly accepted by the branches of the trade involved. Clouds are blowing away and bewildered victims of the present practice of indescriminately labeling this and that fabric "fast" now hope ultimately to see confusion and misrepresentation diminish in the face of this new standardization campaign.

To the trade associations of the cotton industry should go the appreciation of the entire textile industry for instituting the initial step in the establishments of fast color standards. But it is only a step and the big work is still to be undertaken. An exhaustive series of laboratory tests must be carried out before any standards can be determined. Even then the battle is but half won. The standards must be "sold" to the entire trade and to the consumer, whose dissatisfaction with present trade practices has really been the chief cause of this movement for the standardization of the terms "fast to washing" and "fast to light."

The progress of the committee appointed to determine the standards will be watched with interest. It is to be regretted that no member of the Bureau of Standards is on this committee. In the similar investigation, at present under way, to determine standards for the fastness of *dyestuffs,* the Bureau of Standards has rendered aid of inestimable value in its cooperation with the American Association of Textile Chemists and Colorists. From its work on this problem it is obvious that the Bureau could be of equal service to the fabric men.

Of interest, too, will be the campaign to introduce the standards to the textile trade and to the public. Here an extensive educational campaign will be necessary. It will be no sinecure to impress the textile manufacturer with the importance of adhering closely to the fastness standards laid down; to impress him with the penalty for violation, and with the advantages of co-operating with those who have determined the standards not only for his benefit, not only for the benefit of the other branches of the trade, but primarily for the benefit of the consumer. The consumer, along with the retailer, must also learn what the old fastness terms mean when interpreted by the new standards.

Truly, to standardize even so brief a phrase as "fast to washing" or "fast to light" is an achievement that is impossible until after all members of the trade have striven together.

THE NEW GERMAN DYE TRUST

The following official communication, issued by the U. S. Department of Commerce, has been made by the German Dye Trust relative to the new fusion process:

The firms of the I. G. of the German dye industry have come to an understanding with reference to the unification of their manufacturing and sales organization for the purpose of increased unity, cost reduction and improvement of quality. As soon as the necessary preliminary measures are accomplished, the fusion proposal will be laid before the general assemblies of the various companies.

The fusion provides for the inclusion of all firms, with the exception of Cassella and Kalle (whose control and shares are actually in possession of other firms and which are in reality subsidiary companies), into the Badische Anilin und Soda-Fabrik. The Ludwigshafen Company will then exchange its shares for the shares of the above companies, received in the ratio of one to one, and issue new shares against the same nominal amount, thus increasing its capitalization by that of the companies taken over. The name of this fusion company will then be the I. G. Dye Industry Company, and its head office will be transferred to Frankfort. The firms taken over in the fusion will retain their former names as subsidiary companies.

Four production units will be organized out of the numerous manufacturing plants of the I. G. and of their affiliated companies. These original organizations will cover the Upper Rhine, the Middle Rhine, the lower Rhine, and Central Germany. The numerous sales bureaus for the different types of products will be organized into five central and regional sales units.

It is expected that the new board of directors will be composed of the former directors under the chairmanship of Dr. Bosch of Ludwigshafen. The new supervisory board will likewise be drawn from the previous boards. In addition will be added the present chairman of the former boards of directors. These latter, formerly belonging on the central council of the I. G., will be made into a committee of the Aufsichsrat (Supervisory Board), called the Verwaltungsrat (Administrative Board) which will take over the control and transition into the new company, and will effect through division of labor.

The new organization will be effected as soon as possible.

The Berlinger Boersen-Zeitung commented on the merger as follows:

"This new transaction completes efforts which have been carried on for many years and which is based partly on the technical developments of the German chemical industry and partly on the lack of capital. It can be said that this affiliation was formerly rejected by several firms for reasons of prestige but now is accepted under the necessity of present conditions. The union which was made between the Badische Anilin

und Soda-Fabrik, the Elberfeld Dye Company (buyer), and the A. G. fuer Anilin Fabrikation in the year 1904, for the duration of fifty years, experienced in 1916 an expansion to include the Farbwerke, formerly Lucius & Bruening, at Hoechst-on-the-Main; Leopold Cassella & Co., Frankfort; Weiler ter Meer in Uerdinger; Kalle & Co. in Bierbrich, and Griesheim-Chemical Manufacturer in Frankfort. The duration of this expanded community of interest was extended to fifty years (to 1966). Now this looser form of union is given up and the closest type of fusion chosen in which only the smaller firms of Cassella and Kalle are excluded because their control is actually in the possession of other firm.

"From the fact that Bosch has been made the chairman of the board of directors of the new company, one can conclude that the entire transaction was predominantly a result of his own initiative and built upon his own plan.

"The total capital stock of these companies in the I. G. amounts to 641,600,000 marks in addition to 4,400,000 marks, preference shares, giving the Konzern a total capitalization of 646,000,000 marks. Nothing is said as to what will be done with the bonds outstanding, and this is probably not yet certain. Approximately 8,680,000 marks of bonds are outstanding."

TWO NEW INDANTHRENE COLORS

Folders recently issued by Kuttroff, Pickhardt & Co., Inc., describe two new Indanthrene colors, Indanthrene Yellow FFRK and Indanthrene Khaki GG, offered jointly by Badische Anilin & Soda-Fabrik, Farbenfabriken vorm. Friedr. Bayer & Co. and Farbwerke vorm. Meister Lucius & Bruning.

These new colors are suitable for dyeing and printing cotton and similar vegetable fibers. Both dyes are said to be of excellent fastness and especially suitable for colored goods to stand bleaching. They are also adapted to machine dyeing. The folders fully describe their important dyeing properties, give dyeing directions and exhibiting each color on swatches of yarn and piece goods.

NEWPORT FAST SILK GRAY M CONC.

Newport Fast Silk Gray M Conc. is a new color described in a leaflet just issued by the Newport Chemical Works, Inc. It is said to be very useful for producing pure gray tones on silk yarns and pieces where fastness to washing is essential. In addition, it possesses excellent fastness to weak acids and steaming, and its fastness to hot pressing is very good. Its fastness to light is moderate. It is suitable for either pure or tin weighted silks.

Rayon, according to the leaflet, is dyed well, while Celanese and Lustron are only stained. It is not of interest for dyeing either wool or cotton materials, and does not discharge.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, 90 William Street, New York City.

P. C.—Question: We enclose herewith a sample of orange yarn, and would ask your favor to tell us what the fiber is and what the sizing material might be, as we think it too adhesive to be starch or dextrine. What could you suggest for an extra stiff size?

Answer: This fiber is jute heavily sized with starch and dextrine, and dyed in a single operation. If you desire to increase the stiffness we would suggest increasing the amount of dextrine and applying the size quite hot. It would also be well, in order to avoid possible cracking of the twine, to add a small amount of tallow or cocoanut oil to the size kettle.

S. C. L.: In further reference to your recent inquiry for a process to be used for carbonizing artificial silk pile fabrics where the body of the material is of natural silk so that a design may be left in the pile, we suggest the following formula:

A printing paste containing alumina chloride is made up as follows: One pound of alumina chloride crystals is added to 1 gallon of dextrine paste and stirred until the crystals are thoroughly dissolved.

The dextrine paste is made from one gallon of water with the addition of eight pounds of dextrine. As this amounts to more than one gallon, only one gallon is used for the addition of the alumina chloride crystals. The alumina chloride paste prepared as above is applied to the fabric in the usual manner on the printing machine.

After printing, the fabric is passed over a large hot drum where carbonization of the artificial silk takes place. The carbonization is regulated by the heat of the drum and the speed of travel of the fabric. It will be observed that the goods will darken and become a deep brown where the carbonizing paste acts as the fabric passes over the hot drum.

After leaving the drum the goods is brushed, then washed and dyed. The natural silk remains unharmed while portions of the artificial silk pile treated with the carbonizing paste will be entirely destroyed.

T. W. W.—Question: In reading The Reporter I have from time to time come across your column giving excellent advice on technical problems and I would be very glad if you could throw any light on the following:

In making up basic color discharge printing pastes containing tannic acid, for use in the printing of silk goods and also silk and cotton goods I have had a great deal of trouble with specky prints.

This has occurred mostly with blues and greens, combinations of Methylene Blue Zinc Free or Thiomine Blue GO, with Rhodamine B and Thioflavine.

The printing colors showed no signs of speckiness and the preliminary patches struck by the printer showed no specks, but during the running of the machine the color began to break down and show specks.

Sometimes this speckiness was apparent when the goods came out of the hydrosulphite ager; at other times the goods from the ager showed no speckiness at all, but after the steaming process used to fix the basic colors, all the goods came out specky.

I tried putting aniline oil into the color paste, but this gave very much greener and flatter shades than were normally obtained, and I could never get a bright reddish blue with aniline in the color.

A curious thing about this was that if a patch was steamed in a small steam box for experimental purposes, the shade came up bright and reddish as was expected, but when the same goods was steamed in the big steam box, the blue went very green and dirty. I used 8 to 16 ounces of aniline oil per four gallons of color, depending upon the depth of shade.

Then I tried phenol, using 8 ounces of 87 per cent of liquid phenol to 4 gallons of color. This had the effect of causing the separation of Rhodamine B used for shading in oily drops which were fixed on the goods and in the final washing, after steaming seemed to dissolve slightly and spread, forming violet spots in the blue object printed. The thickener used was Textile Gum of the Onyx Company and also Wolf's Textile Gum.

The most puzzling feature of this trouble was its irregularity. Everything would work well for a couple of weeks and then suddenly one job would come up specky. Then for several days again there would be no trouble at all. This was true of both brands of gum used.

The printing pastes were made up by the following general formula:

The dyestuff required dissolved in ½ to 1 gallon water, strained into a mixture of 2½ gallons thickening, 1 to 1½ gallons hydrosulphite solution (4 pounds to a gallon). The whole well mixed and tannin solution added in the amount of twice as much as dyestuff present. The tannin solution was formed by 8 pounds tannic acid, ½ gallon glycerine and water to bring the volume up to 1 gallon.

After aging the goods were steamed thirty minutes at 5 pounds pressure.

I would be very glad if you could give me any information as to the cause of the specking, and any suggestions as to its prevention will be more than welcome.

Answer: We are inclined to believe that your trouble is due to over-reduction and precipitation of the Methylene Blue or Thiomine Blue. In order to prevent this we suggest using the formula given below; the principal points wherein this differs from yours being the addition of glycerine to the color and the inclusion of acetic acid in the tannin solution. The effect of these changes would be to prevent precipitation.

The formula suggested is as follows:

Take 1 part of color to 1 part of glycerine, rub into a paste and add 1 part of alcohol. Mix thoroughly and add 4 parts of acetic acid, 56 per cent. Now add hot water sufficient to dissolve and then sufficient thickening to get the required consistency. When cool add 4 parts of hydrosulphite, dissolved 1:1, and when cold add 3 parts tannin, 1:3. Tannin solution, 1:3, is made up of 1 part tannic acid, 1 part glycerine and 1 part acetic acid.

Before adding the tannin, 1:3, it has been found that an addition of Tartaric acid, 1:1, using the same amount as of tannin, 1:3, will acid in preventing precipitation.

Strain the whole paste and print, then dry. Age one to three minutes and run into steam box to develop the color and steam for fifteen minutes to one-half hour without pressure.

It would be well to open your steam box after the goods have been therein for one or two minutes and allow all steam to escape, then close and continue the process until development is complete. This changing of the steam is desirable in order to allow hydrosulphite gases, which will come off almost as soon as the goods are in the steam box, to escape. If these hydrosulphite gases are allowed to remain in the steam box they are likely to interfere seriously with the development of the color.

The above formula, of course, must be varied somewhat depending upon the shade of the ground color and the depth of the discharge.

The Washington Piece Dyeing & Finishing Company, Paterson, N. J., has awarded a general contract for the erection of a two-story, brick and steel dyehouse on First Avenue, to be 100 by 120 feet, and to cost about $85,000, including equipment.

THE REDUCTION PRODUCTS OF AZO DYES

(*Continued from page 733*)

Derived from: C. I. No. 97.

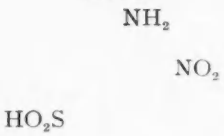
White scales, unstable. Forms no alkaline salts.

Hydrochloride, readily sol. in H_2O and alc., pptted. by HCl. Gives AgCl and silver mirror with $AgNO_3$. Sublimes at 120° in white lustrous cryst. leaflets.

Sulfate, cryst. from aqueous sol. with addition of excess H_2SO_4. Color is light gray (as is that of the hydrochloride).

Diazotized and coupled with acetoaceticester it gives *1-3¹, 5¹-dichlor-2¹-oxyphenyl-3-methyl-5-pyrazolon,* insol. in H_2O, NaOAc and acids, sol. in hot alc. and dil. alkalies.

No. 26.—2, 4-DINITRANILINE-6-SULFONIC ACID



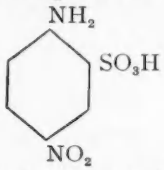
$C_6H_5N_3O_7S$; Mol. Wt. 263.15; (C, 27.4%; H, 1.9%; N, 16.0%; O, 42.6%; S, 12.2%).

Derived from: C. I. No. 160 by partial reduction.

Potassium salt, yellow needles or prisms (H_2O). Readily sol. in H_2O, sl. sol. in alc. and insol. in ether The crystals deflagrate weakly on heating.

Warmed with dil. KOH gives the alkali salt of 2, 4-dinitrophenol-6-sulfonic acid. The latter gives a yellow cryst. Ba salt of slight solubility (100 parts H_2O at 21° dissolve only .036 gm.).

No. 27.—o-SULFO-p-NITRANILINE



$C_6H_6N_2O_5S$; Mol. Wt. 218.15; (C, 33.0%; H, 2.8%; N, 12.8%; O, 36.7%; S, 14.7%).

Derived from: C. I. Nos. 157 and 158 by partial reduction.

Pale yellow needles (H_2O).

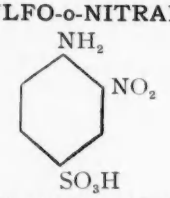
The alkali salts are readily sol. in H_2O. *NH_4 salt,* large, hard, amber colored cubes (H_2O); *Ba salt* ($+2H_2O$), orange-yellow cryst.

Sulfonamide, beautiful glittering needles (hot H_2O), mpt. 210°.

If the acid is diazotized and treated with iodine chloride it gives 2-iodo-4-nitrobenzene sulfonate (K salt), pale yellow needles.

Gives p-phenylenediamine sulfonic acid on reduction.

No. 28.—p-SULFO-o-NITRANILINE



$C_6H_6N_2O_5S$; Mol. Wt. 218.15; (C, 33.0%; H, 2.8%; N, 12.8%; O, 36.7%; S, 14.7%).

Derived from: C. I. No. 159 by partial reduction.

Free acid, yellow, does not crystallize.

Ba salt ($+2\frac{1}{2}H_2O$), yellow leaflets, 517 gm. anhydrous salt sol. in 100 cc. H_2O at 9°. For other metallic salts, see Ann. *180,* 102; *205,* 96.

Hydrochloride, rhombic plates (ether) mpt. 59-60°.

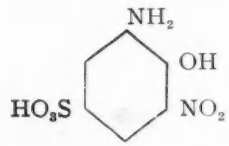
Sulfonamide, deep yellow needles or glittering golden leaflets (alc. or hot H_2O), mpt. 206-7°.

Gives the pot. salt. of p-sulfo-o-nitrophenol on boiling with KOH.

Gives p-sulfo-o-phenylenediamine on reduction.

Gives o-nitraniline on heating with Hcl (sp. gr. 1.2) to 180°.

No. 29.—6-NITRO-2-AMINO PHENOL SULFONIC ACID (4)



$C_6H_6N_2O_6S$; Mol. Wt. 234.15; (C, 30.8%; H, 2.6%; N, 12.0%; O, 41.0%; S, 13.7%).

Derived from: C. I. No. 172 by partial reduction.

Gray-yellow glittering prisms, difficulty sol. in cold H_2O, readily sol. in hot H_2O with a red-yellow color, turned clear yellow with acids and dirty green-yellow with $FeCl_3$.

Alkali salts give brick-red sols. in H_2O. *Ba salt,* red-brown, moderately sol.; *Pb salt,* yellow needles, difficultly sol.; *Cu salt,* green needles.

(*Part IV will appear in an early issue.*)

COMPLETE ADDRESS FOR MAIL

The Post Office Department has for some time past been conducting an intensive and nationwide campaign with the view to having mail plainly, completely and correctly addressed. The co-operation of merchants and other business organizations is earnestly solicited. Merchants and others in business can aid materially by including in their letter and bill heads, and other stationery, particularly order blanks, envelopes, etc., and also in all advertisements, in magazines and in newspapers, their complete street address.

In effecting delivery of mail in large cities, it must be first distributed to station districts and then to the carrier routes. It is obvious that mail is more expeditiously distributed by street and number as when only the name of a firm or building is used, the location must be known to the postal clerk. Names of buildings are frequently changed and in many cases similar. The number of office buildings is increasing so rapidly that the use of names exclusively in addressing mail makes it difficult for post office clerks and railway mail clerks to memorize their names and locations; where, if the street number is used correct distribution may be made quickly without regard to the name of the firm or office building.

Technical Notes from Foreign Sources

The Bronzing of Sulphur Dyed Materials

Besides the great variability in the coloring obtained with the aid of the sulphur dyes, many of these show as well the inconvenient phenomenon of bronzing, and it makes no difference in this connection whether the colors are employed on skeins of yarn, piece goods, spools of thread, etc. This phenomenon is very visible and particularly troublesome, holding up production, in the case of the black and blue sulphur colors.

The character of the materials that are being dyed also has an effect on the places thereon where bronzing occurs, and this pertains as well to the tone of the bronzing and the difficulty of removing the bronze effect after it has formed or of preventing its formation. While the bronzing phenomenon results in shades of lighter tone being produced, and while it is possible to remove these effects by subjecting the materials to a thorough brightening process, nevertheless in dyeing with the dark brown sulphur coloring matters difficulties often arise which tax the ingenuity of the dyer to overcome them.

The bronzing of the color is particularly manifested when the baths are allowed to remain for some time between dyeings and when the bath itself is kept still while the dyeing operation is going on. The addition of various ingredients, such as dekol, gelatine, Monopole soap, tetrakarnite and the like have only a limited action. In general it may be said that there is no method which can be used to prevent the formation of bronze spots on the colored fabrics which will give infallible results all the time.

The addition of 10 per cent of a sulphur green, figured on the total weight of coloring matter employed in the process, was found to be just as advantageous as the addition of 2 grams of tannin per liter of color liquor. An after-treatment with the same amount of tannin at a temperature of 60 deg. Cent. resulted in only a limited effect. When 1 gram of sulphide of sodium is added per liter of the warm wash liquor, at a temperature of 30 deg. Cent., the effect seems to be very favorable. However, the best results seem to have been obtained in the following manner:

The fabric, after being dyed with the sulphur color, was then treated with a 3 per cent solution of acetic acid and a 2 per cent solution of sodium bichromate at a temperature of 60 deg. Cent. The same action is obtained by the oxidation of the coloring matter with chromic acid in the nascent state. But both of these treatments possess the disadvantages of giving a color tone which has a greenish cast and which is rather dull. These treatments are valuable where proper precautions can be taken to secure a dyed fabric which corresponds in color tone and in brilliancy to the sample which is being matched.

In the case of a red color tone, it is not practical to use these methods and it is better to employ a solution containing 1 per cent of sodium perborate at a temperature of 60 deg. Cent. This treatment increases the red tone of the dyeing and makes it appear clearer and more brilliant. Still better results may be obtained by subjecting the dyed fabrics to treatment with sodium sulphide wash water before they are treated with the sodium perborate bath. (For further details see Melliand's Textilberichte, 1925, page 665.)

Dyeing Acetate Silk

When using insoluble coloring matters in the dyeing of cellulose acetate silk, it has been found advisable to bring these dyestuffs into the state of a fine dispersion with the aid of Turkey Red oil. It was then observed that in this condition the coloring matter could easily be absorbed by the fibers and, in fact, color them thoroughly. It is also a fact that there are many coloring matters which are much faster to light when dyed on cellulose acetate silk, than on other textile fibers. Furthermore the resistance of these dyestuffs to light is enhanced by the presence of numerous colorless basic substances, such as aniline, betanaphthylamine or benzidine. In some cases the increase in the fastness of the dyed artificial silk is very marked indeed.

It has been observed that the most potent substance from this standpoint is dialkylanilines, such as dimethylaniline, which can be dispersed in a medium of Turkey Red oil and is then added to the color bath in this form. Only a small percentage of this dispersion is required for this purpose, it usually being employed in the proportion of 2 to 5 per cent. After the artificial silk has been passed through this color bath and then dried, it does not show any noticeable odor due to the presence of these materials. These basic substances adhere very strongly to the cellulose acetate fibers. The protective action that these substances exert on the coloring matter in the acetate silk fibers has been determined to be due, through spectrographic researches, to the absorption of the ultra violet rays of light which are so potent in destroying the color substance. (Jour. Soc. Dyers and Colorists, 1925, page 98.)

Printing Puce and Bister Shades with Dinitronaphthalene

Puce and bister shades, which are fast to soap, are produced on fabrics which are first prepared with glucose. The printing pastes compose 1:8-dinitronaphthalene (1:5-dinitronaphthalene is not suitable for this purpose), caustic soda, and trithioformaldehyde.

For example, the fabric is first prepared with an

aqueous solution of glucose of 8 deg. Be. concentration, having a density of 1.06. Then it is printed with the aid of a printing paste containing 20 parts of 1:8-dinitronaphthalene, 20 parts of trithioformaldehyde paste and 60 parts of an alkaline thickening agent. The latter is prepared from 11 parts of British gum, 5 parts of water, and 54 parts of caustic soda of 1.38 density. Then the printed fabric is steamed in a dry atmosphere for a period of approximately ten minutes, washed and soaped. Indanthrene and algol coloring matters may be incorporated in the printing paste. It has been found that the printing pastes have no deleterious affect on the copper printing rollers, while when the printing pastes contain sulphide of sodium the action on the copper rollers is very marked. (Bulletin Soc. Ind. Mulhouse, 1925, pages 169-170.)

Wetting of Raw Cotton by Hot Starch Pastes

The rate at which cotton yarn is wetted by starch pastes is of considerable importance in the sizing process. Measurements were made to the surface and interfacial tensions first of cotton wax and various oils, second of starch pastes, and third of soaps and other surface-active agents. These substances are commonly added to sizing preparations and such size compositions are tested by the drop-volume method. Direct observations were also made on the wetting of cotton yarns by noting the rate at which a hydrometer, which carries a light frame wrapped around with the yarn, sinks in the paste.

The results that were obtained from this series of experiments indicated that ordinary sizing preparations wet raw cotton imperfectly and reversibly, and that the addition of relatively large quantities of substances which lower the surface tension is necessary to produce spontaneous wetting. The effective wetting of the yarn is not, however, entirely dependent on the ability of the liquid to spread, but can be promoted by using squeeze rollers and working at the boiling point. High temperature is effective, not because of any great alteration of surface tension, but because it facilitates the escape of air bubbles and lowers the viscosity of the size. Temperature is, indeed, a factor needing careful control in sizing. (Jour. Tex. Inst., 1925, 209-22.)

Dyeing Skins and Hair

Skins and hair are dyed by treatment with 4-6-aminoresorcinol dialkyl ethers in the presence of para-diamines, para-hydroxyamines, or their derivatives and homologues, and of oxidizing agents. For example, solutions of 4:6-diaminoresorcinol dimethyl ether hydrochloride and hydrogen peroxide used in conjunction with assymmetrical dimethyl-para-phenylendiamine hydrochloride and ammonia yield deep blue shades on skins, which have been mordanted with copper sulphate; with para-phenylenediamine hydrochloride and ammonia, deep blue shades; with para-aminophenol hydrochloride and ammonia, Bordeaux shades; with para-aminodiphenylamine hydrochloride and sodium acetate, greenish blue shades; and with para-hydroxy-para'-aminodiphenlyamine and sodium carbonate, blue shades are obtained on unmordanted skins. (German Patent No. 412,110.)

Effect of Hydrogen Peroxide on Halogenized Indigo

An investigation was undertaken to determine the effect of 30 per cent hydrogen peroxide on different colored fibers. It was observed that the colors obtained on fabrics with the aid of Indanthrene Blue RS were extraordinarily resistent to the action of the peroxide. On the other hand, a bromine derivative of this coloring matter, which is Indanthrene Blue GCD, could not stand up against the peroxide at all and in a short time the cellulose fiber was decomposed.

In order to determine whether such halogen atoms exert an accelerating effect on the decomposition of the fiber, when they are substituted in the coloring matter, a large number of dyeings were carried out with the aid of halogenized Indigo coloring matters. It was found that the substratum was endowed with extraordinary resisting qualities when halogenized Indigo dyes were employed, which were substituted with halogens in the 6-6' position. It is, furthermore, noteworthy to mention the resistance of colorings which were carried out with the aid of chlorine-bromine substituted coloring matters, as well as the greater stability of the bromine derivatives of the dyestuffs in comparison with the chlorine derivatives. Nevertheless, it appears that the use of bromo-indigo in the dyeing process gives rise to a more rapid destruction of the textile fibers than when they are dyed with unsubstituted indigo. In all cases, after the colored fibers had been allowed to stand for months, long, complete decolorization and solution of the fibers took place.

For further details on this interesting subject see the original article in Leip. Monnatssch., Tex. Ind., 1925, page 18.

Color Discharge Effects on Dyed Cotton Fabrics

German Patent No. 410,302 described a process for obtaining colored discharge effects on cotton fabrics which have been dyed with the aid of vat coloring matters. The process is carried out in such a manner that the reducing effects are developed from formaldehyde preparations, and a naphthol derivative, which possesses the power of coupling with coloring matters, such as the arylenediamines of 2-3 oxynaphtholic acid, is added to the paste which also consists of grape sugar or stannous oxide and alkali. After steaming the color is developed with the aid of diazo compounds.

Water resistant colored discharge effects are obtained, the color varying according to the nature of the naphthol derivative that is added to the discharge printing paste and manner in which the diazo compound is thereafter developed. It is also possible to

obtain white discharge effect on the fabric by the proper choice of reagents.

Dyeing Process

The following is a description of a process of dyeing that can be applied to the coloring of all sorts of fabrics and other substances. It is patented in French Patent No. 580,063.

The coloring matters in this process are not precipitated directly on the fibers, but are formed in the presence of rather large quantities of substances that act as protective colloids, or the coloring matters may be formed in a colloid mill in which case a small amount of organic color may be added.

For example, a separate solution is made of dextrin, a half molecular weight of chloride of barium and the same amount of sodium chromate. These solutions are all made up to the volume of 1 liter. The dextrin solution has a concentration of 2 to 5 per cent. Then the two solutions are made to react in the colloid mill, of the type that was invented by Plauson.

Woolen cloth or yarn which has been boiled off and then mordanted is treated for a period of fifteen minutes to one hour with a suspension of this product. The treatment takes place at a temperature of 60 to 100 deg. Cent. The result is a very remarkable yellow color on the fibers.

Ammoniacal solutions of casein may be employed in the place of the dextrin.

In another method of working the process a solution containing half a gram molecule of sulphate of nickel and 10 grams of casein to the liter of water is passed through the colloid mill. The same treatment is given a solution containing half a gram molecule of sulphide of sodium, 5 grams of casein and from 1 to 3 grams of nigrosine to the liter of water. The operation does not last more than one minute. The mixture that is thus obtained may be used as such or it may be dried, after the addition of glycerine, different sorts of sugar syrup, lactate of sodium, neutral oils, sulphonaphthalic acids and the like.

The proportion of coloring matter that is employed in the process is never any more than 1 to 3 per cent of the weight of mineral matter.

Examination of Mildewed Cotton Material

Current practice in the microscopical detection of fungi on cotton material is briefly referred to in the article that is published in the J. Roy. Micro. Soc., 1925, pages 141-144. Particulars are also given of the improvements in the technic of the method. Canada balsam is used in the place of lactophenol as the mounting medium. Picronigrosine is employed in place of Cotton Blue as the stain in mounting, and the specimen is illuminated by light which is transmitted by a green filter from a "Pointolite lamp." In the majority of cases a two-thirds inch objective then enables the presence of fungi to be detected.

Iodometric Determination of Methylene Blue

The solution is treated with an excess of iodine-potassium iodide solution which precipitates a tetra-iodo compound. The excess of iodine is titrated with thiosulphate solution, which after removing the free iodine attacks the precipitate, liberating Methylene Blue again. The addition of starch is therefore unnecessary. (Chemiker Zeitung, 1925, page 561.)

DYESTUFF TABLES

(*Continued from page 735*)

COMPETING PRODUCTS: Made in the United States by National Aniline & Chemical Company, under name of Alizarine Blue 2RC; N. Y. Color & Chemical Company, under name of Anthracene Blue WR; Palatine Aniline & Chemical Works (Selling Agents, F. E. Atteaux & Co.), under name of Palachrome Blue BRR.

ALGOL YELLOW R

(Schultz No. 817)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Hydrosulphite and caustic soda.

SHADE: Bright golden yellow.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Excellent.

LEVEL: Excellent.

EXHAUSTS: Clear in light percentage.

FASTNESS TO:

Acid: Excellent.
Alkali: Excellent.
Boiling: Excellent.
Chlorine: Excellent.
Cross-Dyeing: Excellent.
Ironing: Excellent.
Light: Excellent; better than all other yellows, including S-849.
Rubbing: Excellent.
Washing: Excellent.
Hydrogen Peroxide: Excellent.

ON OTHER MATERIALS: Silk. Dyes a bright yellow of very good fastness to light and boiling. Wool: At 140 deg., one-fifth gallon of 53 deg. Tw. caustic per 100 gallons; 2 to 4 per cent hydrosulphite. Fast to washing, milling, potting, steaming, light, stoving, ironing, carbonizing, acids and alkalis. Also stands cross-dyeing.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under name of Algol Yellow R.

At Danbury, Conn., the Tweedy Silk Mills have awarded contract for construction of a new dyehouse, to be 40 by 85 feet, and a finishing building, 30 by 150 feet. The estimated cost of both is $17,000.

SLASHING

(*Continued from page 718*)

starch after the boiling point is reached?" inquired Mr. Anderson.

Mr. Files stated that it depends on the kind of work being put through. "If you are sizing heavy yarn and desire penetration, thin boiling starch should be boiled forty-five minutes to an hour, and thick boiling from an hour and a half to two hours, and then provide for the condensation of the steam and bring it to a definite volume."

"Should warps come off the slasher entirely dry or slightly moist, and why?" was the question used to open the next discussion. Mr. Klinck wanted to know, aside from the personal judgment of the operative, whether there is any method of determining the amount of moisture in warps at the slasher, no affirmative answers being given.

"I have two slashers with Powers temperature control on them," stated Mr. Howarth, "and when those warps come off of the slasher I can put my hand on them and they are cool. I can go right over to the other slashers and they are warm. That control is the first thing ever put on a slasher that showed me I had been doing something wrong for thirty-five years." He stated that the amount of moisture in the warps off of the slasher with the regulators was about 6 per cent. When he tried to go to 8 per cent, he said, he encountered serious danger of mildew.

"I don't think there is any doubt in our minds that it is an advantage to have warps come off moist," declared the general chairman. "Most slasher men run their slasher too slow, and they tell whether the warp is dry or not by how warm it is. Just as Mr. Howarth brought out, the temperature control gives a better idea in dealing with the slasher man as to how the warps should feel on the slasher where the control is not used.

"In one of our mills we had a slasher running 16 yards a minute with 11 pounds of steam pressure. We found that by putting on 7 per cent moisture with the same speed the warp did not feel wet. If you will instruct your slasher man to let his warps feel cool when they come off, and run it at the speed to get that effect, or cut the steam pressure down, either one, you will get between 6½ and 7½ per cent. You will probably have to use something to prevent mildew then.

"I venture to say that 75 per cent of the slasher men could speed up their slashers and get better results. Of course, we could find these things out by checking up on slashers that have temperature controls, and running at the proper speed; and then we can get the other slashers operating on the same basis, by the feel. We had the slashers at one mill equipped with temperature controls, and I stood around several hours and thought I had it; and then I went to another mill thirty miles away and speeded up the slashers, and the slasher men told me I would mildew all the warps. But I took the responsibility for the warps in the weave room, and we have not had any mildewed warps, and we increased the speed about 20 per cent."

In connection with his slashers which are controlled, Mr. Howarth said they start out with 8 or 9 pounds pressure in the morning and when the control starts in this might drop to half a pound or vary between 1 and 2 pounds, so that there is not much chance of mildew.

"In starting up your slashers in the morning when the cylinders are cold, as I understand it, this valve is practically wide open, and then the control operates?" asked Mr. Anderson.

Mr. Howarth explained that the control does not work until a certain temperature or heat is attained.

"I have the same control that Mr. Howarth has," said Mr. Phillips, "and we leave in 8 per cent at 152 deg. Fahr. on the cylinder, and that is for 3,000 ends of 22s yarns in the warp. We run 21 yards per minute. We kept speeding up on the slasher until we got as much moisture as we wanted, and had the percentage of moisture determined. Then we had the speed of the slasher and the temperature and established that as a standard, for each different beam. I have run six warps on a stretch without a pound of steam. Four of those ran without taking the cloth off, 570 yards. One had one defect, one had two, one had two and one four on those 570-yard cuts of cloth. We do not run as high a temperature as Mr. Howarth does. It will take 8 pounds of steam until the cylinder gets hot; after that we forget it, even if it gets to zero. I wouldn't run a slasher now without temperature control on it. We do not use anything to prevent mildew. I use rectified tallow and a gum, and control it everywhere in the cooking."

The third question from the questionnaire was, "Has potato starch or any other starch any advantage over cornstarch on your class of work, and why?"

Only one man, R. H. Seymour, of Griffin, indicated the use of potato starch. He said he had been using it for five or six years, on goods ranging from heavy goods to towels and wash rags. They adopted it, he stated, because it increased their production, due to the fact that it requires only about twenty minutes to cook it, and then only have individual kettles on the slashers. He uses about 45 to 60 pounds of potato starch, while he used 100 to 110 pounds of cornstarch. His cooking kettle, he said, holds about 115 gallons. Rectified tallow, with a portion of raw tallow, is used as an ingredient. Some of this is colored goods, he mentioned.

"Do you notice any difference in the looks of the color of the goods where potato starch is used?" inquired Mr. Howarth.

"No, sir; we use fast colors that stand the bleach, and also use direct colors on the raw stock," responded Mr. Seymour.

"But isn't the potato starch more transparent?" asked Mr. Howarth, and the reply was in the affirmative.

"Why did you quit using straight tallow as a softener in you size mix?" was the next question put by Mr. Ar

nold. He explained that this question "might not apply to a lot of you because you never did quit, but what we want to bring out is why it is not better to use tallow instead of some softener. In other words, the man who asked this question felt that in buying these softeners he is getting a lot of oils and fats without the same softening qualities of tallow; that you could take fewer pounds of straight tallow and get the same results.

"My objection to using raw tallow," said Mr. Seymour, "is that the animal matter, after it begins to cool, produces a certain amount of grease and after that it rises to the surface, and you must keep it at 190 to 212 degrees to prevent this. Then you will find it on your goods, and you can smell it also. It has a very rancid color. That's why I use a patented compound with my raw tallow, to hold down that animal matter."

"I think myself that the rectified tallow goes into solution more readily," said Mr. Arnold.

The final topic discussed concerned the best ingredient to use for preventing mildew. Mr. Arnold stated that, putting in about 8 per cent moisture, he found some mildew, and that he uses about 3 ounces of creosote to a kettle of 150 gallons of size.

For preventing mildew, Mr. Seydel recommended the use of a permanent salt. He explained that most organic compounds are very easily carried away by steam—and that such organic antiseptics as creosote, carbolic acid, salicylic acid, benzoic acid, etc., are subject to volatilization on the drum of the slasher, when it is heated to a considerable temperature, so that there probably is no trace of the antiseptic when the warp leaves the slasher.

Zinc salts—sulphate of zinc, oxide of zinc, carbonate of zinc and zinc chloride—are among the most efficient and most readily available antiseptics for preventing mildew, he declared.

Asked for a specific recommendation by Mr. Arnold and Mr. Anderson, Mr. Seydel stated that a proportion of 1 per cent would be sufficient to prevent mildew under ordinary conditions, with not more than 8 or 9 per cent moisture in the warp.

Questioned as to formaldehyde, Mr. Seydel declared that this is the most volatile of all, as a temperature of 200 degrees will eliminate it. Creosote, he said, also evaporates rapidly, and that carbolic acid is an aromatic compound of the same family.

With 7 per cent moisture in the warp, something to prevent mildew is necessary, declared Mr. Seydel in response to a question from Mr. Arnold.

"Well, would there be danger of using too much antiseptic?" inquired Mr. Anderson.

"No," said Mr. Seydel, "for the necessary proportion is too small. For example, take zinc chloride, which has been accused of decomposing into zinc oxide and hydrochloric acid. This occurs only at a very high temperature, and there is no possibility of its happening in sizing. Zinc chloride is fused at 400 degrees, but it does not decompose there."

SEVERAL NEW SHADE CARDS ISSUED BY GENERAL DYESTUFF CORP.

Among the shade cards recently issued by the General Dyestuff Corporation is a folder exhibiting three-color effects on mixtures of cotton, acetate silk and viscose silk with the new Cellit fast colors manufactured by the Farbenfabriken vorm. Friedr. Bayer & Co. These colors are described as adapted for dyeing acetate silk, and are said to level well, yield clear, bright shades and be suitable for hank and piece dyeing.

Other shade cards and folders issued by this concern show the Supramine colors, Katanol W on half-silk, combination dyeings made with Naphthol AS-G and AS on cotton pieces, and white and color discharges, as well as two recent colors, Benzo Fast Blue 8GL and Essex direct Fast Yellow AF.

The swatches on the color card showing the Supramine series manufactured by Bayer & Co. illustrate self-shades, combinations on knitting yarns, their suitability for woolen hats in the half-planked state, white cotton effects on Covercoat material and shades on suitings. Dyeing directions are given in a folder attached to the card.

The Katanol W folder contains swatches of half-wool, half-silk fabric. The text of the card states that mordanting with Katanol W prevents certain colors from being absorbed by the wool or the silk, resulting in silk-white and two-color effects. The application of this product, which is also manufactured by Bayer & Co., is given in detail, with a list of suitable benzo colors for use in conjunction with it.

The shade card showing combination dyeings with Naphthol AS-G and AS on cotton piece goods illustrates dyeings from yellow through to scarlet produced with the Naphthol products in combination with Fast Scarlet GG. Formulas are given for each dyeing. Naphthol AS-G and AS are products of Chemische Fabrik Griesheim-Elektron.

White and colored discharges produced with Naphthol AS, AS-BO, AS-BS, AS-RL and AS-SW are illustrated in a handy bound book of sixty pages, the latter section of which is devoted to the swatches showing only those combinations which are of practical value for cotton printing because they can be discharged to a white. These include seventy-four swatches in which oranges, scarlets and browns predominate, although there are some very attractive two-color combinations. These swatches fall into four classes: Rongalite discharge with 30 per cent Rongalite C without anthraquinone; Rongalite discharge with 30 per cent Rongalite and anthraquinone; Rongalite discharge with 30 per cent Rongalite CL and anthraquinone, and Rongalite C color discharges with vat colors. Complete directions are given in the text.

The leaflet describing the properties of Benzo Fast Blue 8GL states that the main features of this color are its greenish blue shade and very good fastness to light. It is also said to possess good fastness to alkali, acids, rubbing, stoving and ironing. This product is used, like

others in the Benzo Fast series, principally for piece dyeing or for yarns requiring good fastness to light but not to washing.

Essex Direct Fast Yellow AF is one of the latest domestic products of the Grasselli Dyestuff Corporation. It is said to be of special interest because of its fastness to alkali, described as superior in this respect to the corresponding Stilbene Yellow types, which renders it particularly suitable for paper used for bill posters, signs and wallpaper where strong alkaline glues or gumming pastes are applied.

C. E. Moss, formerly general manager of the Far East for the Newport Chemical Company, has taken over the management of Hemingway & Co., which is a subsidiary of the Sherwin-Williams Company, Cleveland. Mr. Moss will specialize in the sale of coal-tar chemicals and allied products.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1924, OF AMERICAN DYESTUFF REPORTER.

Published biweekly at New York, N. Y., for October 1, 1925.

State of New York, County of New York, s.s.:

Before me, a notary public in and for the State and county aforesaid, personally appeared Alfred P. Howes, who, having been duly sworn according to law, deposes and says that he is the publisher of the American Dyestuff Reporter, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 445, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are:
Publisher—Alfred P. Howes, 90 William Street, New York City. Editor—Louis A. Olney, Lowell, Mass. Managing Editor—Clayton Hoagland, 90 William Street, New York City. Business Manager—Alfred P. Howes, 90 William Street, New York City.

2. That the owner is: Howes Publishing Company, Inc., 90 William Street, New York City: Louis A. Olney, Lowell, Mass.; Alfred P. Howes, 90 William Street, New York City; Mary K. Howes, Northampton, Mass.; William F. Collins, Upper Montclair, N. J.; Derfla H. Collins, Upper Montclair, N. J.; N. H. Hiller, Carbondale, Pa.; Joseph L. Schroeder, Hartsdale, N. Y.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest, direct or indirect, in the said stock, bonds or other securities than as so stated by him.

Alfred P. Howes, Publisher.

Sworn to and subscribed before me this 30th day of September, 1925.

[Seal.] Edwin Safford.
(My commission expires March 30, 1927.)

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Leaflets just issued by the National Aniline & Chemical Company describe three new additions to the National line: National Alizarine Sapphire BN, Sulphur Yellow 2G and Fast Light Blue BL.

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Index to Advertisers Appearing in This Issue

Althouse Chemical Co.	—
American Aniline Products, Inc.	III
American Dyewood Co.	—
American Laundry Machinery Co.	—
Amid Duron Co.	—
Arabol Manufacturing Co.	—
Arkansas Co.	XIII
Arnold, Hoffman & Co.	—
Atlas Electric Devices Co.	—
Bosson & Lane	XIII
Borne, Scrymser Co.	—
Calco Chemical Co.	XII
Campbell, John, & Co.	V
Carbic Color & Chemical Co.	—
Ciba Co.	XIII
Corn Products Refining Co.	—
Cowles Detergent Co.	IV
David, S. R., & Co.	XVI
Dunker & Perkins Co.	XVI
Du Pont de Nemours, E. I., & Co.	—
Dyer & Calico Printer	VI
Fleischmann Co.	IV
Fortner, L. B., & Co.	—
Foster, Edward C.	—
French Lick Springs Hotel	XV
Geigy Co., Inc.	—
Hussong Dyeing Machine Co.	VIII
Innis, Speiden & Co.	—
International Nickel Co.	—
International Salt Co.	V
Jennings & Co.	IV
Kali Manufacturing Co.	X
Klauder-Weldon Dyeing Machine Co.	IX
Klipstein, A., & Co.	Back Cover
Lewis, John D.	XV
Malt-Diastase Co.	—
National Aniline & Chemical Co.	XI
Newport Chemical Works	Front Cover
New York Color & Chemical Co.	X
Onyx Oil & Chemical Co.	X
Permutit Co.	VIII
Roessler & Hasslacher	—
Rohm & Haas Co.	VII
Sandoz Chemical Co.	IX
Society of Dyers and Colourists	Third Cover
Solvay Process Co.	IX
Suter, Alfred	IX
Textile Finishing Machinery Co.	Second Cover
Tinc Tura Laboratories, Inc.	XV
Tolhurst Machine Works	—
United Chemical Products Co.	VI
U. S. Color & Chemical Co.	IV
Vellner, Eugene	—
Wolf, Jacques, & Co.	VII

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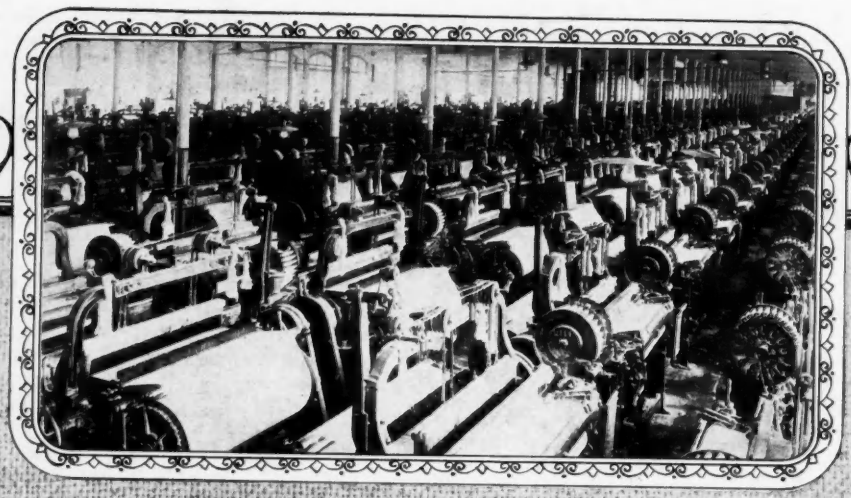

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